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The AUTOMOBILE

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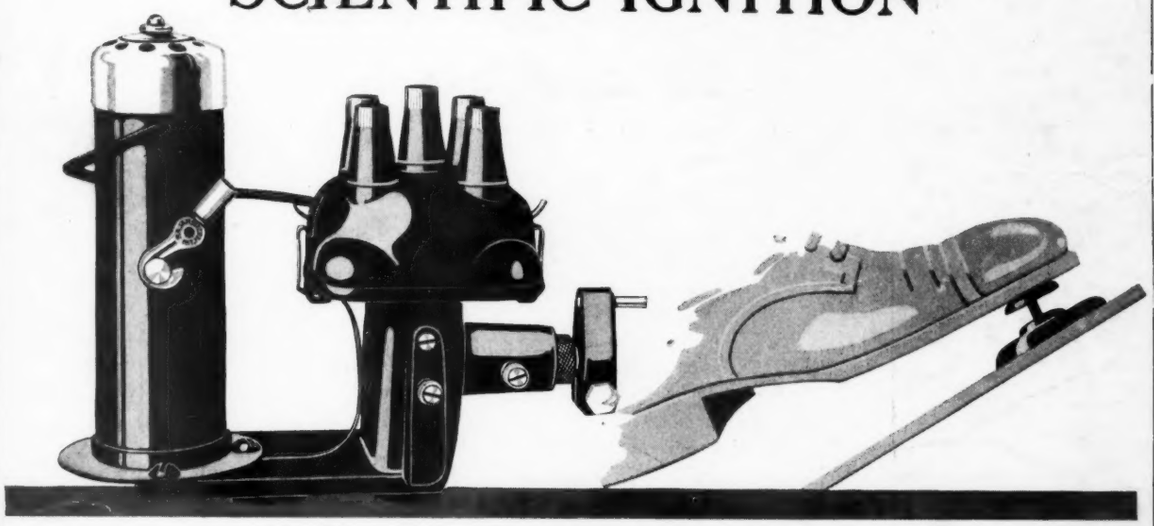
Simple in Construction—Unfailing in Performance

ATWATER KENT
SCIENTIFIC IGNITION



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There's a type of Atwater Kent Ignition for every car made.

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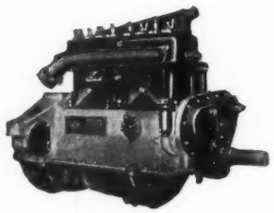


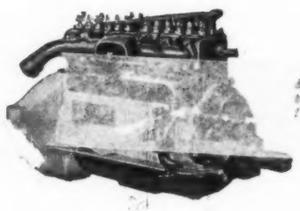
America's Standard Truck Motor. Look for the Red Seal Nameplate.

"Let's all keep industry humming by working together — employers and employees—in harmonious cooperation.

"U. S. DEPARTMENT OF LABOR.

"Wm. B. Wilson, Secretary."

Continental Motors



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AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

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Views Held on Commercial Possibilities in Aviation

Conservative Control of Industry Essential to Avoid Errors of Over-Optimism That Would Give Setback to Aerial Commerce

By David Beecroft

LONDON, Jan. 21—The undreamed of growth of military aviation in Great Britain since August, 1914, constitutes the greatest reason for her laying bold plans for unexpected progress in commercial aviation now that peace has come. Figures of aviation growth during war read like chapters from the Arabian tales. In 1914 Britain had but 285 officers in her Royal Air Force. When the armistice was signed she had over 30,000. In 1914 she had but 1853 of all other ranks, which insignificant total had reached 260,000 in November, 1918. To this total must be added 30,000 women and boys connected with the force in November, 1918.

British Capacity 40,000 Planes Yearly

When the armistice was signed Great Britain had factory capacity to build 40,000 airplanes and 30,000 aircraft engines per year. Some of her finest war factories have been built for aircraft production. Not only are these among the largest, but they are the most modern. The world has nothing that surpasses them and few that rival them.

Add to this the history of the Royal Air Force during the war and it is not surprising that the future of aviation in England is provoking more discussion and is the cause of more comment than any other subject. This is rightfully so, because the aircraft industry is the only one that was entirely without pre-war standing, and hence had no pre-war establishment to fall back upon as have practically all other war industries. There is little wonder that in a land like the British Isles, where there have always been more men than jobs, that not only the government but also those back of the aircraft factories should be bending every effort in weighing the possible future of aviation, which means largely commercial aviation.

Military Requirements Relatively Small

There is no disputing the fact that army and navy requirements on a peace basis cannot consume more than a small fraction of the possible production of the aircraft factories now in existence. Either these factories must be turned over to other uses, such as manufacture of bicycles, motorcycles, furniture, motor car bodies, etc., or be salvaged by the government.

The possible alternative is forcing commercial aviation, which could not possibly take up the factory slack. Fortunately the conservative element in British aviation is so far in control of the situation and it appears that Great Britain and probably the

world is to be spared the debacle that would inevitably follow should all kinds of commercial, passenger, and mail services be hurried into existence, with the primary aim of keeping the aircraft factories on a rational scale of production.

Lord Weir, who until the recent election was head of the Royal Air Force, has been a leader in the present plan for conservatism in commercial aviation, and who incidentally is one of the greatest aviation enthusiasts, summed up in his recent Manchester address the sane policy for commercial flying when he said:

Impatience Will Prejudice Future

"I am an enthusiastic optimist on the future of aviation, but I hope my optimism is sane, and therefore I shall venture to insist that in this highly critical period in the history of the new transport nothing but harm can come from not facing the facts; and I will add my opinion that the future of aviation may be greatly prejudiced by impatience for showy results. The success of the operational side of air transport will depend upon measures that cannot be carried out in 5 minutes.

"These measures are: The development of navigational instruction by really sound and severe navigational training, the creation of an energetic meteorlogical service specially designed to help air transport, the adoption of improved systems of wireless telegraphy and telephony, and the adoption of a first-class system of day and night marking of landing places and aerodromes.

"If these measures are taken I am quite clear that 5 years hence there will be no more difficulty in navigating an airplane over a long course in foggy or otherwise bad weather than there is now in navigating a ship at sea.

"If these measures are not taken, if hard and continuous experimental study is not put into the problems yet unsolved, then trouble, delay and discouragement will certainly ensue.

Study and Experiment Necessary

"The technic of flying and the organization of air transport still demand long study and many experiments for their perfecting. True, wondrous stunts are performed in the air, and these stunts have been immediately useful in the art of war and they will continue to be useful for the testing of machines, but aerial gymnastics and acrobatics in the firmament have really little to do with the operational side of aviation.

"The air traveler of the future will have no desire to take part in a circus. He will want to be sure that on a given day, to be settled in advance, he can leave, say, London at a certain hour in the morning and arrive, say, at Marseilles at a certain hour in the afternoon, whatever the weather."

This view of the essentiality of conservatism is shared by most of the leading aviation spirits in Great Britain, including those with large financial investments in factories and aerodromes. They all agree that rash precipitation in the starting of passenger and freight aircraft services, and attempting to operate them even on a symptom of schedule would prove the sorest boomerang to the development of commercial aviation along all lines.

The opinion is very generally shared by all in Great Britain, France and Italy that the worst that possibly could happen would be starting a passenger service from London to Paris and endeavoring to maintain a schedule. Such a service is to-day impossible except for purely military uses, but if the laws of international flying, which will be approved so far as the Allies are concerned at the Peace Conference, permitted such it would be equivalent to suicide for the future of the industry to attempt such at once. One serious accident such as a crash of a large plane with twenty to forty passengers aboard would almost certainly result in the death of most of the party and would set back passenger aviation transport perhaps a decade. Such an accident is the very thing not needed to-day. Such an accident is the very thing that all those men with heavy investments in factories are doing all in their power to guard against. This conservatism of theirs is the best proof of their confidence in the future of flying and the truest criterion of their deep-founded enthusiasm and optimism in the art.

One Accident in 25,000 Miles

This conservatism does not mean that planes have not been a success in war, or that the art of flying has not been adequately mastered. A few figures on the amount of flying done in certain periods of the war disprove this. Accidents during the war appear less alarming when the facts are considered. Figures obtained since the armistice show that in training and flying there has been only one accident for every 25,000 miles covered by the Zeppelins and the Gothas, the latter the large German bombing planes.

This percentage of accidents can be reduced very greatly under a peace regime, and even in war they do not appear so great when the amount of work accomplished by planes is considered. Take photography alone: the R. A. F. in 6 months of 1918 took 250,000 photographs on the western front, photographing every acre of the 6000 square miles covered. In area this is equivalent to a rectangle 200 miles long and 30 miles wide. Over much of this territory it was impossible to land without crashing the machine, a condition which would not rule to anything like the same extent in commercial flying. A portion of these photographs were taken at night by the use of flares, which proved successful.

War Aviation Achievements

In war flying there was much work done that gave an indication of what may be expected from commercial developments. Bombing by airplane started in 1917, when the British dropped 1000 tons of bombs, but in 6 months of 1918, and the first 6 months, 6000 tons were dropped on the western front alone. This amount was only limited by the lack of bombing planes which were only getting into production in England when the armistice came up.

Had the war lasted a few weeks longer there would have been British planes bombing Berlin, and hundreds of new bombing planes would have been produced each month.

G. Holt Thomas, head of one of the largest aircraft factories in England and who for 10 years has taken a leading interest in commercial aviation, summed up his convictions on the subject in these words:

"Aerial navigation will revolutionize the world not only from a commercial viewpoint, but from a humanitarian point, much more indeed than it has revolutionized warfare, although the effect on warfare has been very great.

Flying a Transportation Adjunct

"I am not one of those who think that commercial aeronautics are going to beat railways and other forms of transport out of existence, but rather that flying will act as an adjunct to the present modes of transport.

"For those in a hurry nothing can compete with the airplane, and for those going on special services it is of the greatest use. This alone opens a very wide field indeed.

"Commercial flying will be carried out in short stages of 250 miles per flight, and pilots will not fly more than three or four days per week. It will be necessary before flying can be carried out commercially to have landing fields every 10 miles.

"Our commercial machines will have a speed of at least 100 miles per hour and engines for these should have a useful life of 500 hours between complete overhauls. Our engines will be heavier than those used in war machines, and cost of manufacture will be reduced as weight of engine is permitted to increase. In 5 years no water-cooled engine will be used. Air-cooling is certain to become universal in commercial aviation and the star or radial design of engine with fixed cylinders offers the greatest possibility in this field of development.

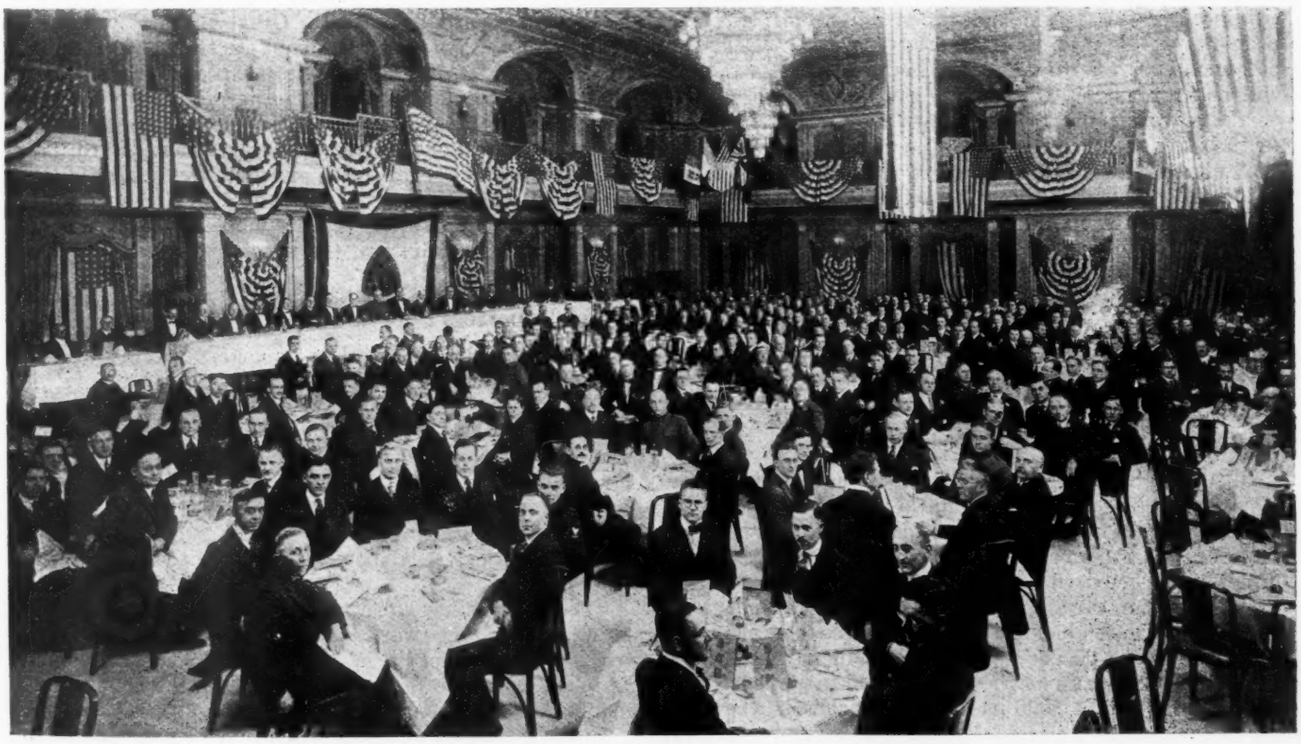
"The future of the dirigible is one to attract firms considering the aircraft field. The dirigible is destined to be the great vehicle for oversea transport, and is the only machine suitable for transatlantic work. The Atlantic may be crossed this year by an airplane, but such accomplishment will serve of little value as a commercial accomplishment, but rather will merely serve as a demonstration of aircraft pioneering. The future of trans-ocean travel lies locked-up in the lap of the dirigible.

The Freight-Carrying Plane

"The freight-carrying airplane has yet to be developed, although several types used in war can be used in this field. The freight airplane will have a speed of at least 75 miles per hour, and its primary requisite must be reliability. Its engines must be the last word in efficiency and reliability."

Like Lord Weir, Mr. Holt Thomas is a great aerial enthusiast, but he is an equally conspicuous aerial conservatist. He, too, recognizes the ill that will

Home-Coming Supper of the S. A. E. During Chicago Show



More than 400 members of the Society of Automotive Engineers and their guests attended the Home-Coming Supper of the S. A. E. during the Chicago show

come to the industry if precipitate rashness is given a rampant leash.

Perhaps the final word from Great Britain on the commercial possibilities of aviation and the best attitude to take with regard to the aircraft industry in Great Britain comes in the final report on civil aerial transport recently issued by a committee of representative character on this subject. This committee recognizes the gravity of the present factories and the industry as a whole and also the course to pursue regarding commercial flying. They reported that:

"We strongly support the views that the carriage of mails, of passengers, and of certain classes of goods by aircraft will present no difficulty from the technical point of view. We are confident that demands for aerial services to provide such carriage will arise immediately at the conclusion of the war, and that it is imperative that every endeavor should be made to prepare for these demands. Such aerial transport service cannot be developed by the ordinary commercial methods so as to secure the required result, and the state must take action of some kind in developing such service."

This committee looks forward to several improvements in aircraft before it has progressed far in its commercial stages. The increased use of folding wings and the use of some form of braking mechanism so as to diminish the space needed for landing must be anticipated. Possible developments in the gyroscope, the turbine and directional wireless are looked for.

Great Britain to Continue War-Time Restrictions on Automobile Apparatus

Some Months Needed for British Industry to Start Peace Plans

LONDON, Jan. 17.—For the present there is little hope of a removal of the total restriction order prohibiting the importation of automobiles and motor trucks into Great Britain. Ever since the signing of the armistice automobile and truck importers of French, Italian and American makes have been asking for a ruling but without success.

To-day a group of manufacturers representing practically all of the leading industries waited on Sir Albert Stanley, president of the Board of Trade, which has the power on such matters, and they were assured that there will be no removals of restrictions on any class of merchandise without first consulting with the British manufacturers engaged in the same line of manufacture. This can only be interpreted as meaning that in the case of the automobile, truck and farm tractor the British maker will express his opinion to the Board of Trade before any removal or consideration of removal of restriction will take place. This declaration of policy is not considered favorable to the importer, who has the feeling that the British maker wants the total restriction continued for several months until he gets squared around, decides what he is going to produce as a post-war model and gets ready for production of such.

Will Impose Additional Restrictions

In a few instances import restrictions have been removed since the armistice, but the Board of Trade announced that in every case these restrictions would be reimposed and further intimated that additional restrictions will be imposed as necessary. None of the restrictions on motor car imports had been removed except in one or two individual cases, and so this clause of the Board of Trade decision does not specifically apply.

The Ford company has been permitted to go ahead with the manufacture of 3000 passenger car chassis, the parts for which were imported by the government for war uses. These are now being assembled at the rate of 60 per day, and when the supply of parts is exhausted the production will practically cease. In the meantime the company is getting ready to manufacture all of the parts in Manchester. These cars are being sold at $1,000, which is a high advance on pre-war prices and which price is understood to apply only to these 3000 chassis. The parts were purchased at war prices and war freights paid on most of them, which explains to an extent at least the high price. It is understood Sir Percival Perry, manager of Ford interests in Great Britain, was given permission to go ahead assembling these 3000 chassis in consideration for his having cancelled certain government contracts at once. The permission to assemble these 3000 chassis would otherwise be considered a special favor to one importer over another. Ford, however, is the only concern with an assembly factory in England, and this comes as a natural favor for such enterprise. The bodies for these were made in the Manchester factory, as are radiators, the sheet iron work and some other parts.

Other Importers Concerned

In the meantime the other importers are not over-optimistic. They maintained their salesrooms and service buildings during the four and one-half years of war and at the same time most of the men were engaged on one kind of war work or another. Since the armistice they have been doing a good business in used cars of all makes. In some instances the same car has been sold not fewer than three different times since 1914, and the last selling price was 25 per cent above the original sales price when new.

These importers have kept their service departments going during the war, many having government contracts for small parts of munitions. Some have made as much money as in peace times, and some have greatly increased these departments since 1914.

In the meantime their salesrooms are empty except for a used car or two, as the only action they have obtained

(*Continued on page* 341)

Dealers' Interpretation of Public's Desires Real Show Lesson

Individuality in Outline and Color, with Great Attention to Detail in Show Cars

By J. Edward Schipper

THERE is a lesson in the New York Show for automobile manufacturers, one which if taken cannot help but leave its stamp on the industry. The lesson is brought home by the dealers of New York who have produced a show which is a brilliant success from a merchandising standpoint. What the dealers have learned in their intimate contact with the public, the manufacturer can in turn learn from the dealer by a study of the underlying features of the display at Madison Square Garden and the 69th Regiment Armory.

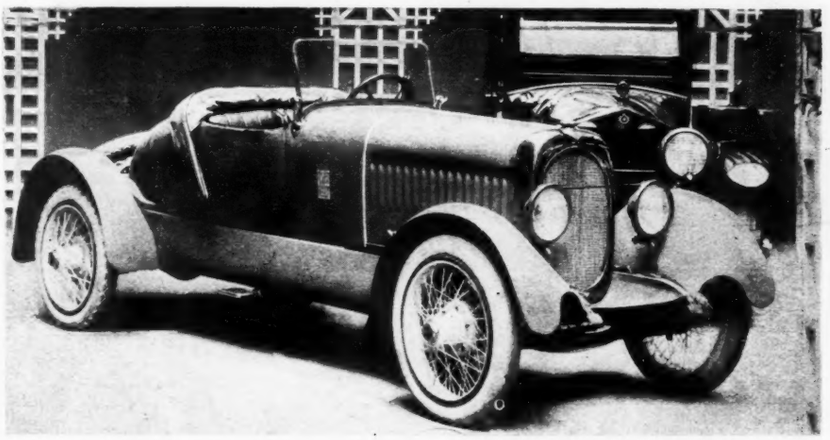
Manufacturers have felt themselves at a loss during the last few weeks to interpret properly the feeling of the public as expressed in their desire for cars. The dealer knows the public because he is constantly rubbing elbows with it and is always in touch directly with the ultimate buyer. He has not had to turn his attention to war manufacture in a way which would cause him to lose that intangible contact which is so necessary to successful sales plans.

The fact that this is a dealers' show has made it possible for the dealers to give free rein to their knowledge of the psychology of the buyer, with the result that the display fairly sparkles with silent salesmanship that is really compelling the attention of buyers to a degree not equaled at any show for years. Cars are being bought off the floor in record numbers and prospect lists are growing with a rapidity that is astonishing the most optimistic of dealers.

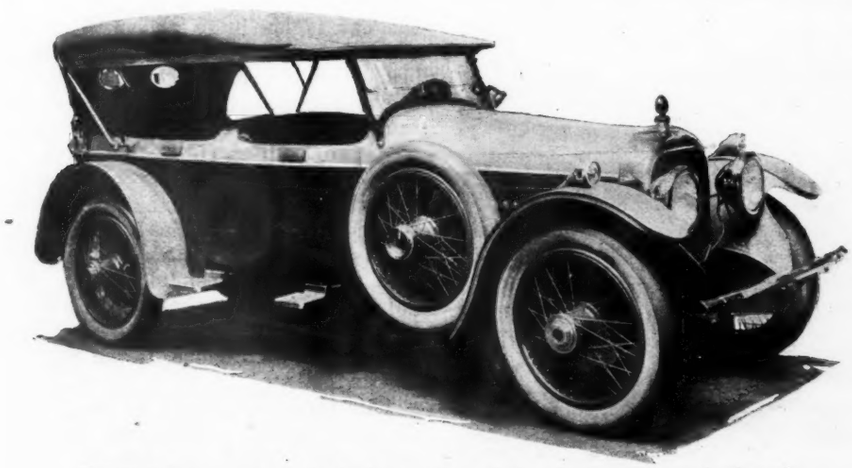
* * *

Distinctive Bodies the Keynote

It is in the body of the car that the secret seems to be contained. The American public, at least that part of it centering along the upper Atlantic seaboard, is yearning for individuality. There is a desire to break away from the somber color, the cut-and-dried body line—and to have a car which expresses the purpose for which it is intended. The New York Show is an exhibit of special bodies. Many dealers have not a single stock body on the floor. They are showing bodies which have been designed for them to meet the ideas of the public that they are used to serving. The result is that in the Garden and the Armory there is a display of striking bodies that practically equals what we have been used to finding at the Importers Salon.



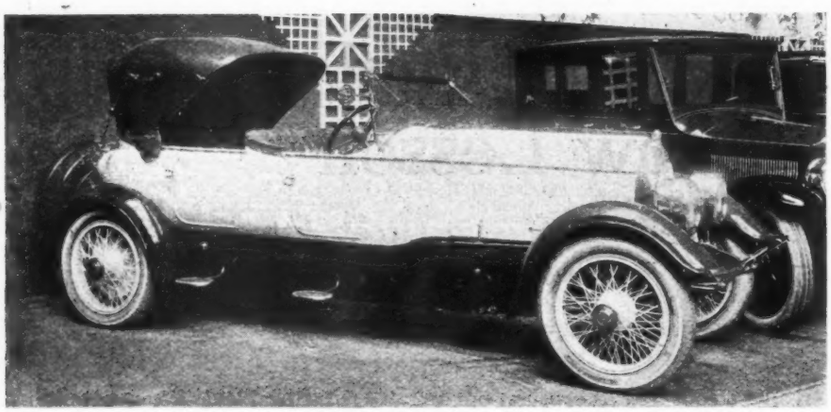
The Noma, which is the only really new car at the show, features a distinctive type of roadster body



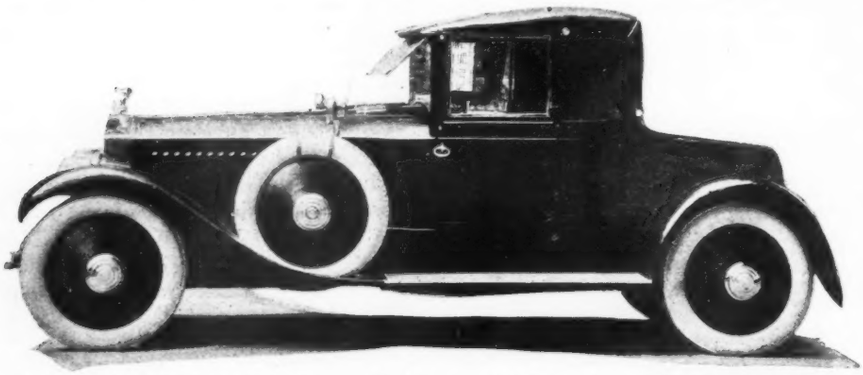
Unusual treatment of the body panels and the absence of runningboards mark this special Cunningham model

It is not possible to put these bodies into production. It would not be desirable to put many of those which are proving of the utmost interest to car buyers into production, but the bodies which occupy the booths of the exhibitors are so replete with suggestion for the manufacturer that his engineer and designer could spend a week in close study of the ideas here evolved without exhausting the subject. Refinement of detail alone could occupy the attention of a man for three days.

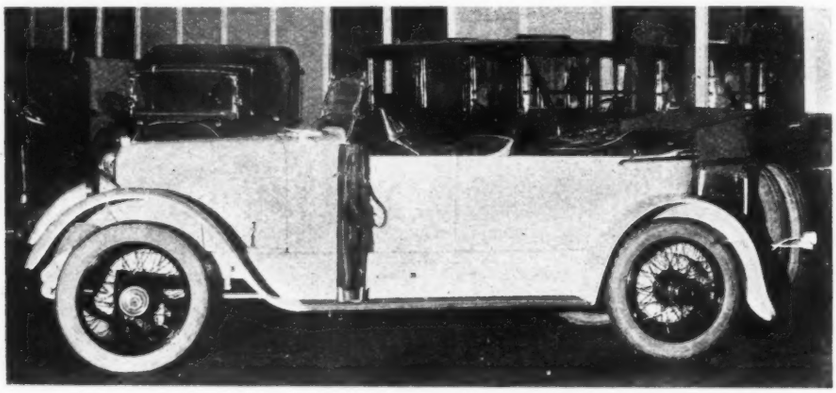
Equally important is the departure



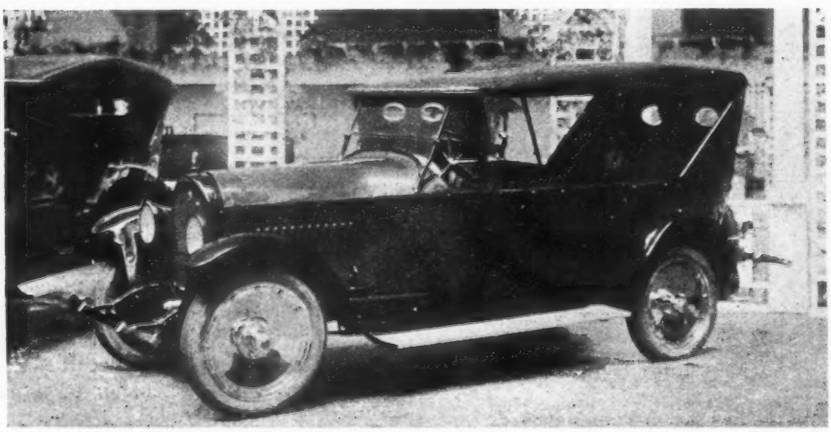
This is a Brooks-Ostruk touring body on a Pierce-Arrow chassis



Another Brooks-Ostruk body—a cabriolet model fitted to a Rolls-Royce chassis



Daniels exhibited a white touring car, reflecting individuality in bodies



Disk wheels very considerably alter the appearance of a stock model, as may be seen by this standard Westcott

from the conventional lines of the past and the suggestion of exterior lines which not only lend themselves with the greatest of adaptability to useful purposes but which strike the American buyer at a point where he is becoming very vulnerable, that is his taste for personal individuality.

It is true that the buyer of the Metropolitan district is different from the buyer of other districts. He does not use his car for business nearly as much, since, as a rule, he is a dweller of the larger cities, where the impossibility of parking makes it necessary for him to keep his car in the garage for the business week. This makes him perhaps an even more enthusiastic motorist than his Mid-Western brother who uses his car every day of his business life. Since the dwellers in the Eastern district number about 10,000,000, or one-tenth of the population of the country, the wishes and modes of living of this part of the country become a considerable factor.

* * *

Sport Bodies in Demand

If the manufacturer will study what the dealer in New York has found to be a potent factor in the selling of cars, he will find that the man who uses his car for pleasure always seeks to get away from the usual and get something which interprets the purpose for which the car is intended. In a word, there is a demand for a sport type of car that is unfilled, and yet this demand is so keen that special cars of this type made up by dealers and mounted on standard chassis are being snapped up by the public. They are being bought eagerly off the floor of the Garden and the Armory.

The sport type is not the only car that appeals. The closed car of special lines is even more popular. When the car is low-hung, when the seats are comfortable and yet have enough head room for passengers and driver they make an appeal which is not being resisted by the Metropolitanites who are pouring into the show in record numbers. The pendulum is swinging over to the side of unrestrained desire for the gratification of wishes that were denied during the war days. The pendulum has not gained the impetus that it will have a little later. In fact, the show is one of the first indications of the returning swing.

This is not an appeal to the manufacturer to put a different body on every car turned out, but it is an attempt to reveal a lesson that can be taken home and interpreted on a production basis—the necessity for re-

fined detail, the advantage of breaking away from the crowd, if it can be done without the semblance of freakishness and with the accomplishment of a result in usefulness as well as appearance. A study of many of the bodies on the floor which at first sight are special all the way through brings to light that it is only the fit of the doors, the arrangement of the trim and the really artistic paint work that distinguish it from the regular stock model.

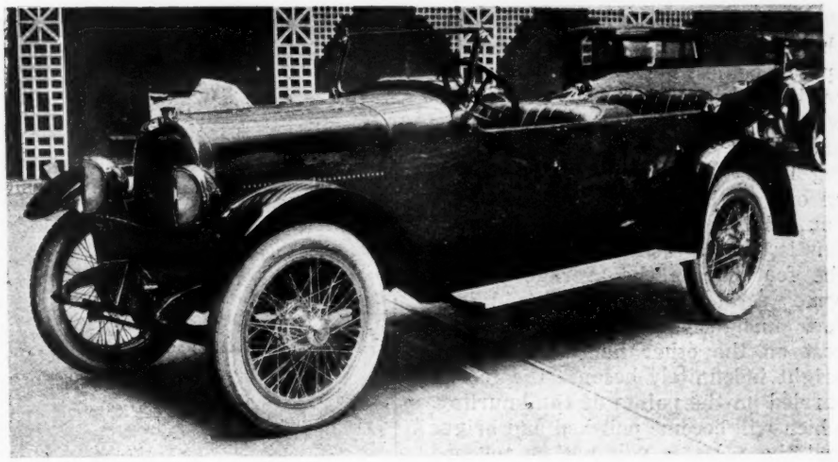
* * *

Special Bodies Not for Low-Price Cars

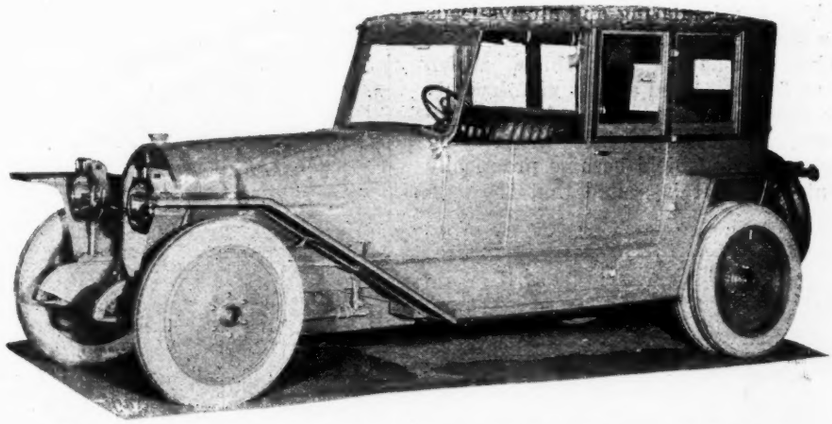
One of the points which cannot help be noted is that it is foolish for the manufacturers of low-priced cars to attempt things in body design which can successfully be carried out in higher-priced cars. There is nothing, for instance, so difficult to produce commercially at a low price as a body in sheet metal that depends for its appearance on a bold straight line. A line of that sort is either straight or crooked. There is no intermediate. It cannot be more or less straight. It is either straight or not. This means careful work and substantial building which cannot be taken care of on a production basis where a matter of 50 cents per car is regarded as serious.

Imitation of a successful thought by another manufacturer who perhaps makes a car costing five or six times as much cannot always be made a success. This is quite evident when the cars stand side by side at the show. This has another angle which does not show itself on the surface. Often the design of the higher priced car is one which entails structural weakness unless it is accompanied by the best kinds of materials or by compromises in other directions. A simple example of this will explain what is meant. The concealed hinge on the doors of touring and other open cars was first adopted by manufacturers who could pay a high price for the skillful work required in making concealed hinges as nearly correct as they could be made. Manufacturers of cars of all price ranges fell in line, with the result that door rattles on American cars are practically as common as the cars themselves. Furthermore the doors do not open as far, and there have been many torn garments as a result. After the bad experience with the various types of concealed hinge there is a big return this year to the exterior hinge, where even in the lower priced jobs the strength is sufficient to allow a man to sit on the door without making an incurable rattle in the joint.

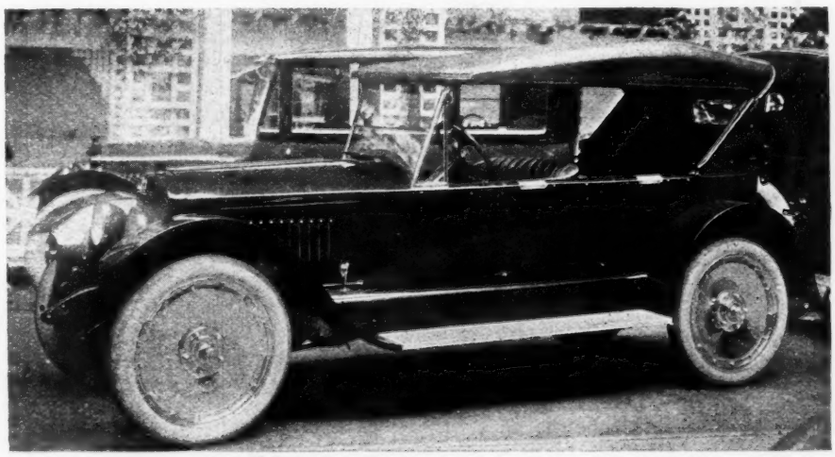
Beading over the edge of doors has proven very satisfactory. It is possible in the high priced cars to get a flush door that really fits, but an inspection of the doors of the lower priced cars shows that the difference in the width of the opening is very marked on bodies coming through in the same production run. The moulding allows for this nicely.



Paige exhibits a type of sporting touring model in which the high hood and rather unusual lamps are noticeable



Special type of Locomobile limousine designed for the use of General Pershing. Note dual rear tires and windshield



A Standard touring model has an unusual windshield with side pieces that increase protection and grace the shield

There are a great many little kinks that make their appearance on the special bodies, however, which can be readily taken as production items without adding materially to expense and at the same time greatly increasing utility or beauty. For instance, on one of the Locomobiles there is a knurled foot rest. The advantage of this is quite evident. In a short time the foot bar in the average car becomes scratched and worn and is a very unsightly affair. The knurled rest on the other hand will remain bright indefinitely because the foot is carried on the points of the knurling, which will become polished and bright and the recesses will not be touched by the foot, thus allowing them to retain their finish.

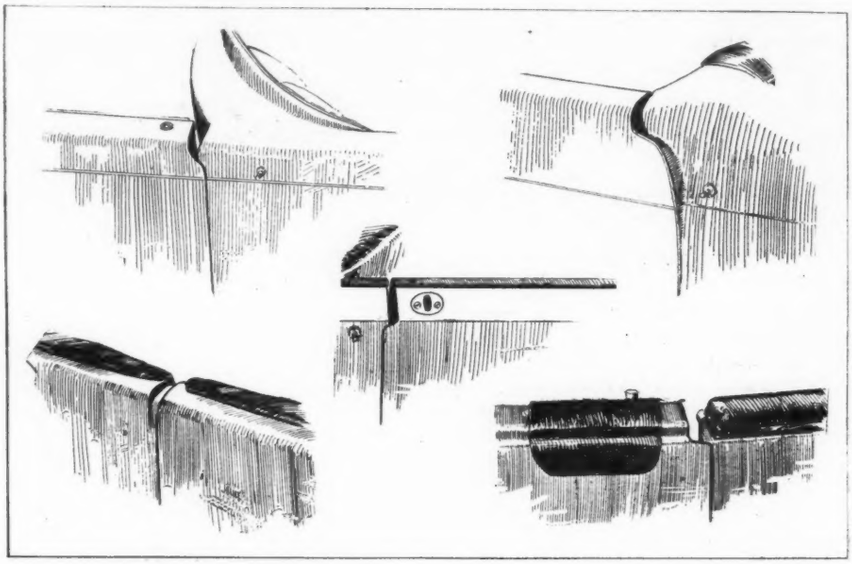
Differences in opinion over details in body design provoke a discussion which is stimulating and always leads to the best solution of the problem. The overlapping windshield which was first accepted almost unanimously is now a matter of considerable debate, particularly since the sloping type of windshield became practically universal. It is stated that the rain is swept into the overlap groove and that no protection is offered at all. The result is that many of the cars at the show have a rubber moulding inserted in the strip. This is not the kind that was used three years ago and was always falling out or becoming lost, but is a semi-permanent fixture.

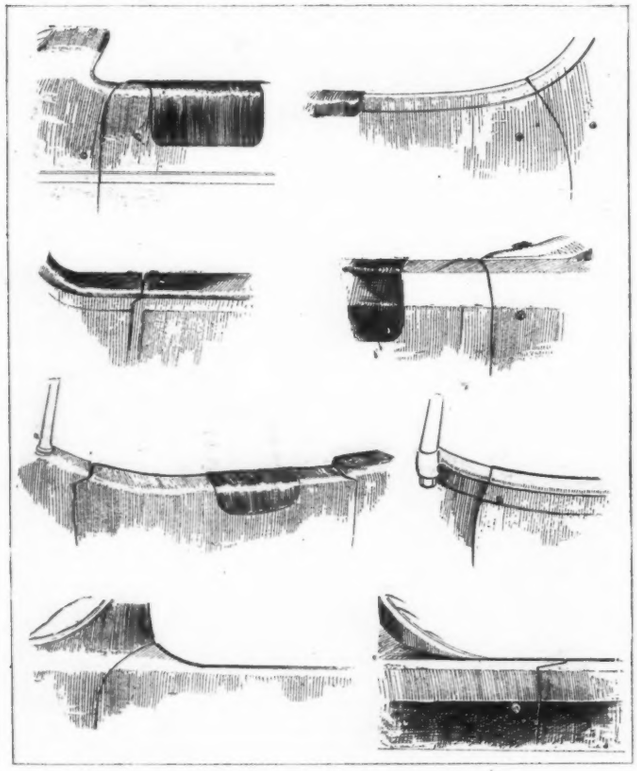
* * *

Are American Cars Too High?

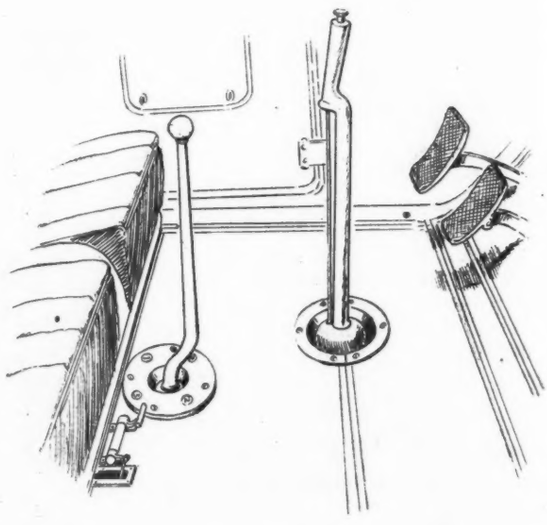
Returning travelers from Europe who are close students of automobile design say that their first impression of our cars after a long sojourn abroad is that they are all too high. They state that it is not because we have more clearance than the cars abroad, but because of the smaller wheels and the suspension layout. It is a matter of comment among these men that our cars seem high in the air, particularly at the rear. The closed cars of Europe have their tops often on the level of the top of a man's head when he is standing on the ground. As there are many of our cars which are so high that it takes an upstretched arm to reach the top, it cannot be solely a matter of clearance. Our cars have more head room inside, but it is a question if this is really needed, as there is no necessity to stand in the car.

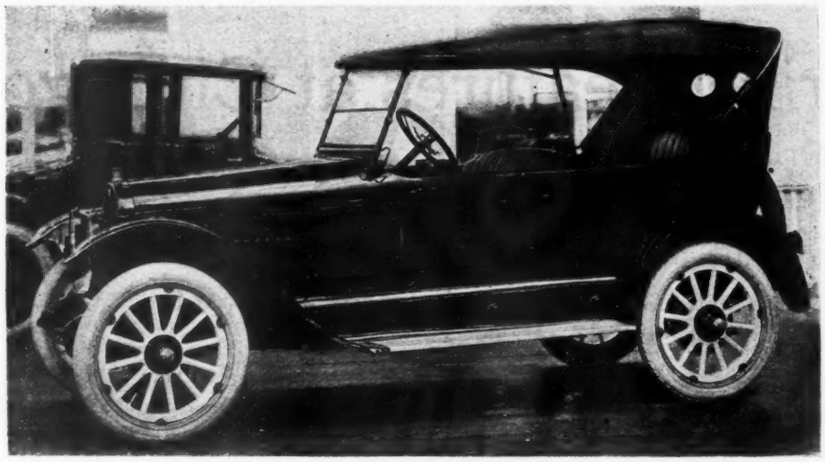
All of these matters deal with de-





Above are a few prominent examples of poor body fitting, both at the hinge and at the jamb ends of doors. At the left are a few examples of well-fitting doors. Below is the unusual arrangement of the control levers in the McFarlan





A new Mitchell model makes its appearance at the show

tail and yet they serve to bring out the general fact that since the cars at the show excel in this respect, and since the cars are largely special insofar as body design is concerned, it is necessary for the manufacturer to get a closer interpretation of the desires of the buyer. It is going to be a matter of getting back in this respect because the ordinary avenues of information have been closed during the war period.

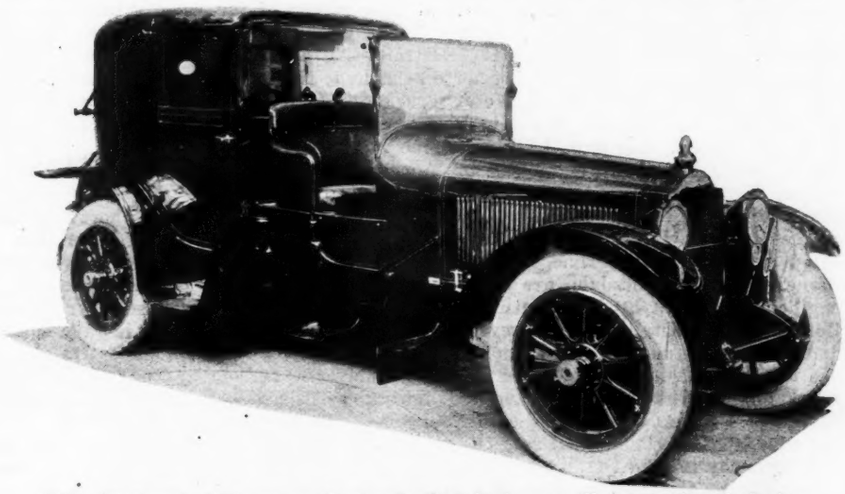
The use of more colors than ever shows that there has got to be a departure from the old standard black. Where we get into color it means that more than one color has to be offered, which brings us back to where we were 5 years ago in the matter of color options. These were gradually weeded out by the manufacturer who made cars in quantities, although the 10-a-day maker has kept some of the options.

There is a well-established demand for a real sport car. This demand is evident enough to justify its production in quantities. Abroad, the makers have realized this market far more than we have, and there is hardly a maker who does not have a stock sportster. This car would not only sell along the Atlantic seaboard, but would be in demand throughout the country, although the Metropolitan district would no doubt present the greatest demand for the reasons already explained. This sport car must not be something freakish, but should satisfy the lover of suburban excursions or of country-club life, a person who is greatly on the increase in large as well as small communities. This type of car is admittedly a recreation vehicle or implement to as great an extent as a golf bag or a tennis racket. Automobiling is the recreation of tens of thousands of Americans. A big percentage of these would be appealed to directly by such a car. The New York show tells that story.

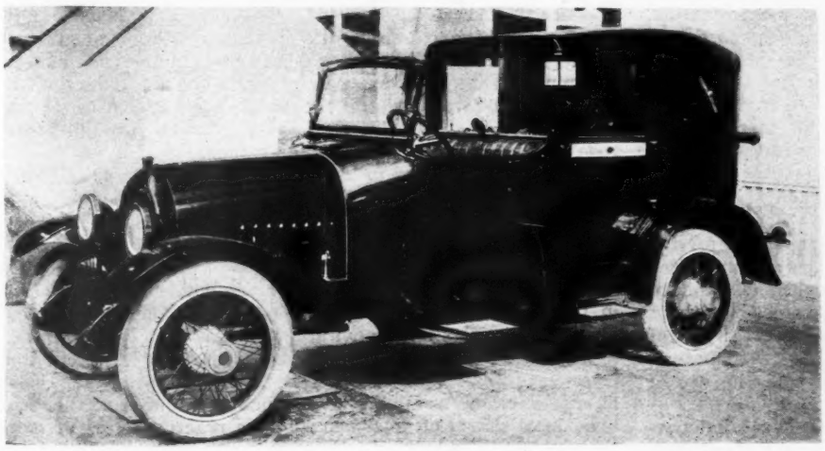
* * *

Public Has Been Educated

One great thing must be remembered in selling our new products. We are selling to a public which is buying its second, third or fourth car. This means a public which wants something different in appearance from what it had before; something refined, in which the little past mistakes are corrected. Refinement of detail, individual bodies, distinctive but enduring and serviceable color, all are being looked for, far more than radical engineering development at this particular stage of the industry's development.



This Holbrook body on a Packard chassis is a well-proportioned design, though quite out of the ordinary



Somewhat similar treatment of the fenders is apparent in this Daniels town car model, which, however, has front doors

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Fiat Supplied Over 50,000 Motor Vehicles

NOW that restriction against publishing the actual output of factories supplying material to the armies has been removed, the Fiat Co., Turin, Italy, has made public the statement of the number of cars and lorries it supplied for army use.

In 1914, while Italy was neutral, only about 500 vehicles were supplied. Between Jan. 1, 1915, and Oct. 30, 1918, the number totalled 50,000. Of this number 30,000 went to the Italian army, 15,000 to the French and 5000 were divided among the American, British and Portuguese armies.

New Engineering Features at Chicago Truck Show

Ten Makers Exhibit for First Time and There Are Nine Other New Models—Tendency Toward Oil Lubrication of Chassis Parts Apparent—One Steam Truck Appears

CHICAGO, Feb. 3—Contrary to general expectations, there is much in the way of engineering advances and in the number of new models at the exclusive motor truck show which opened here to-day under the auspices of the Chicago Automobile Trade Association.

No less than ten new companies exhibited their vehicles for the first time at any show and nine brand new models of trucks of old concerns are shown. Among the new concerns formed during 1918 and putting their wares on display for the first time are the following:

Winslow Motor & Engineering Co., Chicago, maker of the only steam truck at the show; Mutual Truck Co., Sullivan, Ind.; Paige-Detroit Motor Car Co., Detroit; All-American Truck Co., Chicago; Dearborn Truck Co., Chicago; Hebb Motors Co., Lincoln, Neb.; Tower Motor Truck Co., Greenville, Mich.; Transport Truck Co., Mt. Pleasant, Mich.; Nelson Motor Truck Co., Saginaw, Mich.; and the Panhard Motors, Grandhaven, Mich. New models of Acme, Master, Commerce, Signal, Dorris, Stewart, Available and Fulton trucks are shown.

The Brockway modified Class B war truck could not be shipped to the show in time, although two other makes, the Signal and the Clydesdale, are fitted with modified Class B engines as offered by the Continental Motors Co., Detroit. Both of these installations, however, have single instead of double ignition, making use of magnetos. This requires the use of a new detachable cylinder head with only one set of spark plugs. The electric starter and lighting as originally furnished on the Class B engines are missing from those so far employed for commercial service.

A tendency toward the use of oil instead of grease for the lubrication of the springs, bolts and shackles is also evident, fourteen of the fifty-two makes of trucks exhibited employing some form of oil lubrication. These include the Patriot, Couple-Gear, Brockway, Paige, Master, Rainier, Clydesdale, Bethlehem, Indiana, Nash, Lapeer, Oneida, Available and Dorris. The Mutual truck, which at first used oil, is the only make shown which now employs grease.

The turning up of grease cups at the proper intervals has always been one of the hardest things to get a motor truck driver to do. The use of oil cups makes it much more convenient for the driver. Two brands of trucks use the Alemite method of greasing, in which a small cylinder is screwed into the hollow spring or spring-shackle bolt. This cylinder has a small check plunger which is forced in to admit the grease from a regular grease gun so that the lubricant does not have to be put in with the fingers.

Closed Cabs Increase

There is also evident a tendency to fit inclosed cabs for the protection of the driver, and about six of the models exhibited are so equipped. In most cases these are furnished as standard equipment and included in the set price of the chassis without the body. Some are of wood and others of metal, more of the latter type being evident this year than ever before. Some others accomplished the same end through the use of curtains.

Two new models of Available trucks have several departures in design, including a new method of brake equalizing, a new method of front axle mounting and a two-step runningboard. The brake equalizing is accomplished by two flat equalizer rods, one above the other, which run in slotted members fastened to the under side of the truck frame near the midpoint of the chassis. These rods extend crosswise of the frame and move forward in a longitudinal direction toward the front end of the truck as the brakes are set and backward as they are released.

The Timken rear axle used has two brakeshoe segments in each drum, and under the ordinary method the two forward shoes are moved into contact with the drum when the emergency brake lever is pulled, or vice versa, and the two rear shoes when the foot pedal is used. This sets up a strain in the axle which the Available company has overcome by connecting one of the rear shoe rods to the transverse equalizer rod on one side and one of the front shoes on the other side, thus tending to equalize the entire action.

Improved Steering Connections

The front axle of each of the new models is set on a slant from the front to the rear by making the rear end of the spring lower than the front. When an obstruction is encountered, the wheels tend to mount it without the strains set up when the axle is set level. The steering arm knuckle is also set over the centerline of the axle so that its arc of movement is very small when the spring is deflected. This gives an easier steering truck.

The All-American truck heats its fuel four times before it enters the cylinders. These four heatings are made possible by mounting the gasoline tank directly above the engine under the hood, by a hot-air jacket around the air intake pipe leading to the carbureter, by passing the gas through the cylinder block after it has left the carbureter and by then making it impinge on the hot sides of the intake manifold, which is cast integrally with the exhaust manifold.

The Winslow steam truck is perhaps the newest vehicle at the show. The Winslow company has built only one model to date, the 5-tonner at the show, although it is intended to bring out smaller units at a later date. The truck is fitted with a four-cylinder engine with the cylinders cast in pairs and set in a V of 90 degrees. The engine is placed under the floor of the cab and drives direct without any clutch through a tubular propeller shaft with universals to the worm-driven rear axle. An emergency gear reduction 3.5 to 1 is provided, making the total gear reduction to the rear wheels 41 to 1. The final drive is taken through radius rods and the torque through the springs.

The water is carried in a transverse tank under the driver's seat and is fed, by a special worm-driven boiler feed pump, to a horizontal water-tube boiler carried in a crosswise compartment behind the driver's seat above the floor.

The boiler is fired by kerosene, which is also carried in a tank under the driver's seat. A large condenser is mounted in the place of the usual radiator. Its makers claim that one of the truck's main advantages is the low cost of fuel.

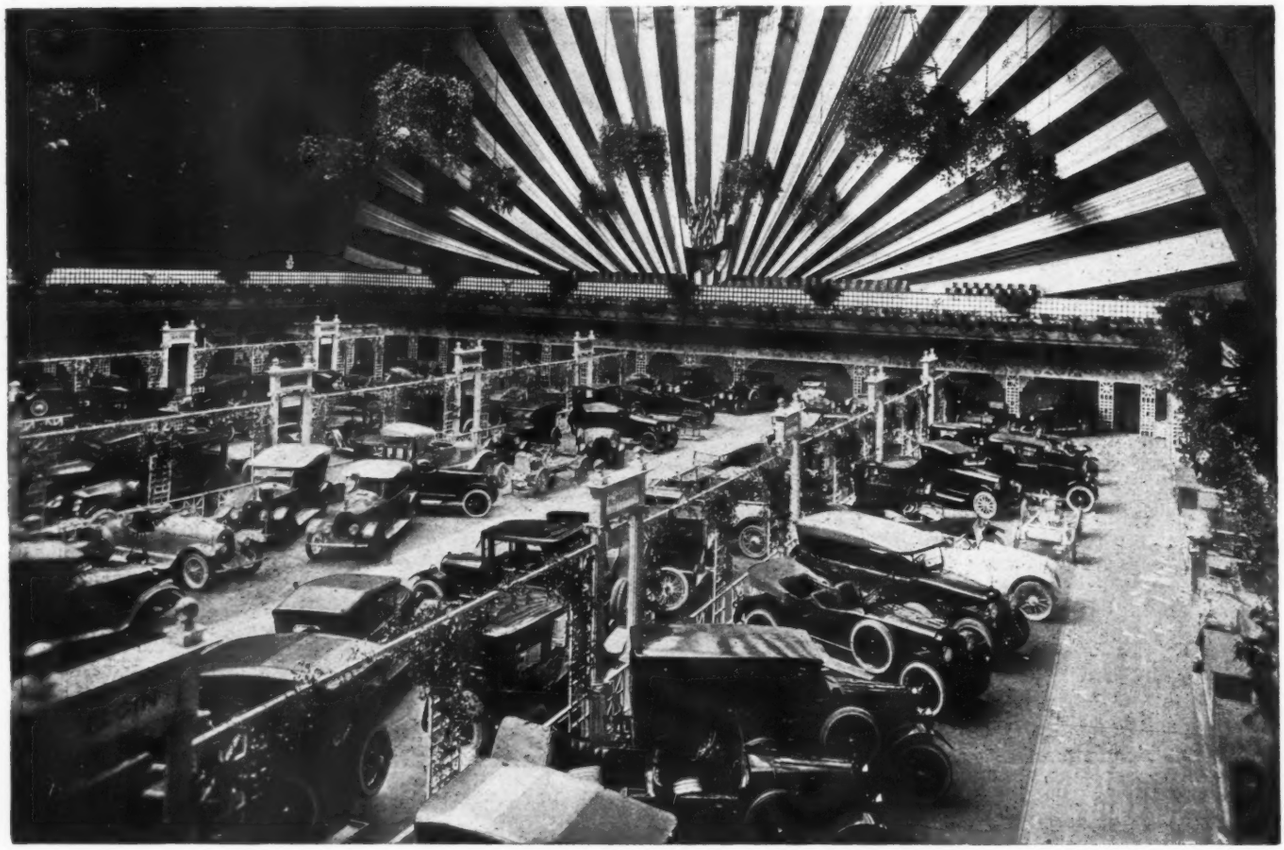
Another claim is for a great tractive effort in starting, it being said that the truck has an available torque of 13,200 lb. in., making a maximum available torque for the rear axle drive shafts of 45,100 lb. ft. or a tractive effort of more than 12,500 lb., which will far exceed the friction between the wheels and the road, even when the truck is fully loaded.

Two Views of the Chicago Motor Truck Show

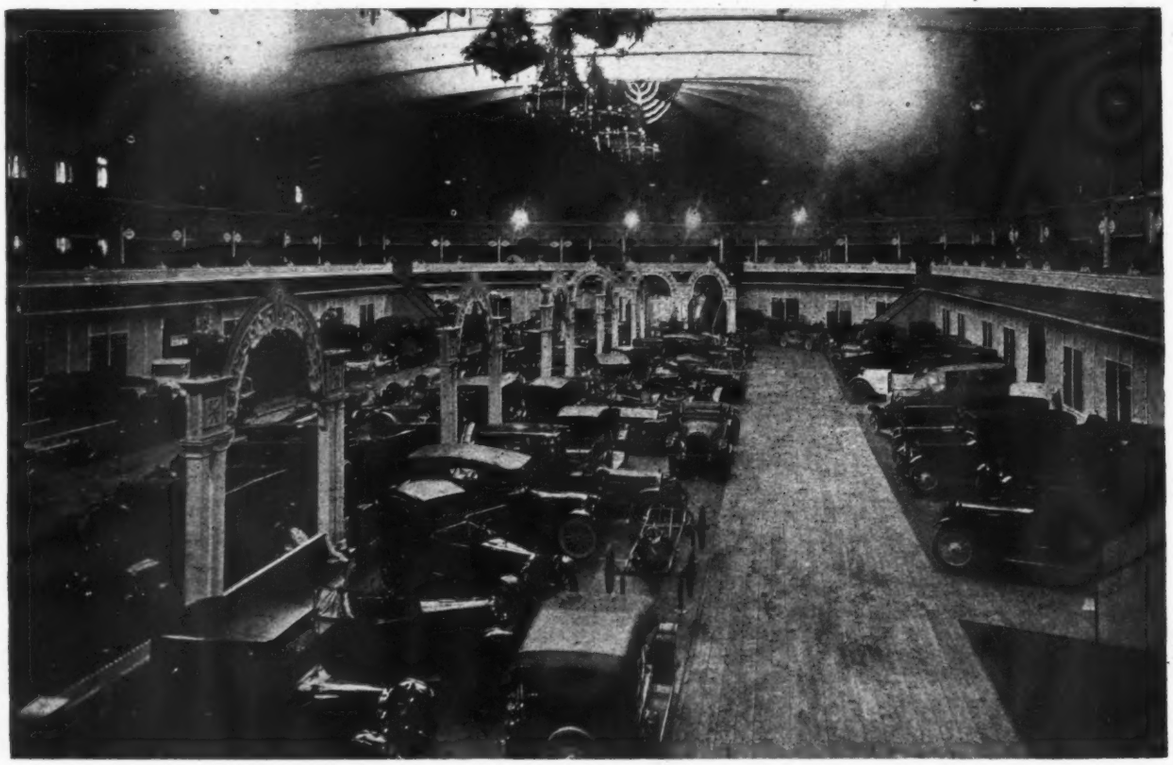
Present appearance of the Coliseum which last week housed the passenger car show but this week holds the motor truck exposition

In the First Regiment Armory, where part of the truck show is staged, a Navy seaplane occupies the center of the floor and attracts a lot of attention

Two Views of the 19th Annual New York Show



Looking over the 69th Regiment Armory from the balcony over the entrance



General arrangement of Madison Square Garden

Analyzing Body Design at New York Passenger Car Show

Close-Coupled Touring Bodies Are Prominent—Light Colors and Color Combinations Are Popular—Many Minor Refinements

By George J. Mercer

BOTH Madison Square Garden and the Sixty-ninth Regiment Armory may be termed "body shows" in the sense that while there may be nothing startlingly new there are many very good-looking jobs and a high average of uniform excellence, design and workmanship is evident.

Small, close-coupled touring bodies are very prominent. These are designed to carry four or five passengers, have no extra seats and are fitted with four doors. Body sides are lower and the adoption of the bevel top edge accentuates the low effect. Straight lines give a clean cut, well defined contour and give a pleasing air of definiteness. It should not be assumed that finality in body design has been reached in this type, the ability to produce something new is far from being exhausted and there is still opportunity for enterprising designers.

There are three distinct points in connection with these bodies which afford great possibilities to the designer: First, the carrying of the body line forward across the cowl; second, the blending of the back line of the cowl with the body side, and, third, the blending of the front seat back with the body line. There are numerous instances illustrating the different manner in which these may be carried out. Some are excellent—some are not so good.

In the case of the first point, the effect is always best when the line of the top of the body side is continued through to the radiator. Sometimes this is accentuated by a paint stripe which looks well, but it should be a straight line, although it may deviate at the rear of the body. For instance, on a runabout it may drop downward and on a touring body it can go upward, but for the major part of its length, and especially at its front end, it must be straight.

It is not easy to explain the second of the three points clearly. Briefly, the line of the back of the cowl should join the top line of the body without being abrupt. An angle is better than a radius, but the best results are obtained when the line of the cowl is curved, making the meeting of the two lines at a tangent so that the cowl line blends easily.

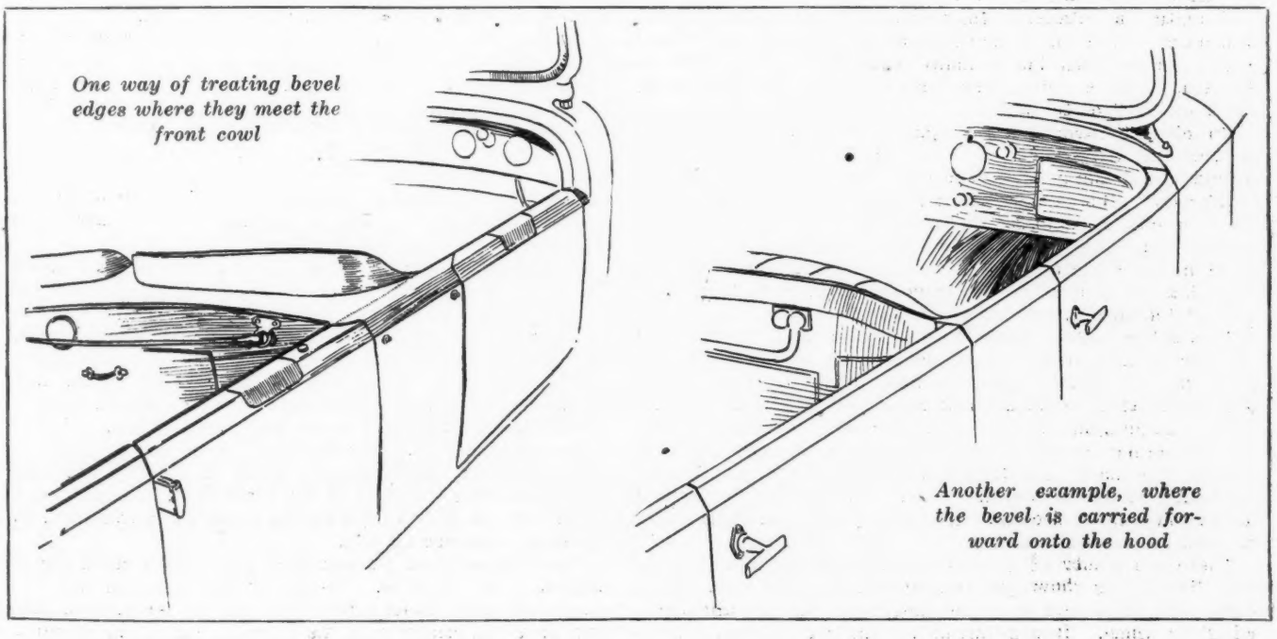
More thought has evidently been expended on the third point, although it has been difficult to illustrate many of the good effects by means of the sketches reproduced. The Paige is a typical instance. It is one of the newest, and has merit, as it permits the use of any form of second cowl or seat-back to fit to the body side without destroying the continuity of the latter. Good results can be obtained when the second cowl is a continuation of the bevel of the top line of the body side, but conditions must be favorable to assure relative perfection, as in the case of the Westcott.

The Essex has square rear corners. These look well on a short body and are favorable for fitting the guards to the body side. A finish panel covers the back end of the chassis frame and the gasoline tank. The Daniels small touring body has a platform at the rear which is used for a trunk.

The idea of having a body as long as the chassis is seemingly going by the board and indications are that short bodies will become more popular than ever before.

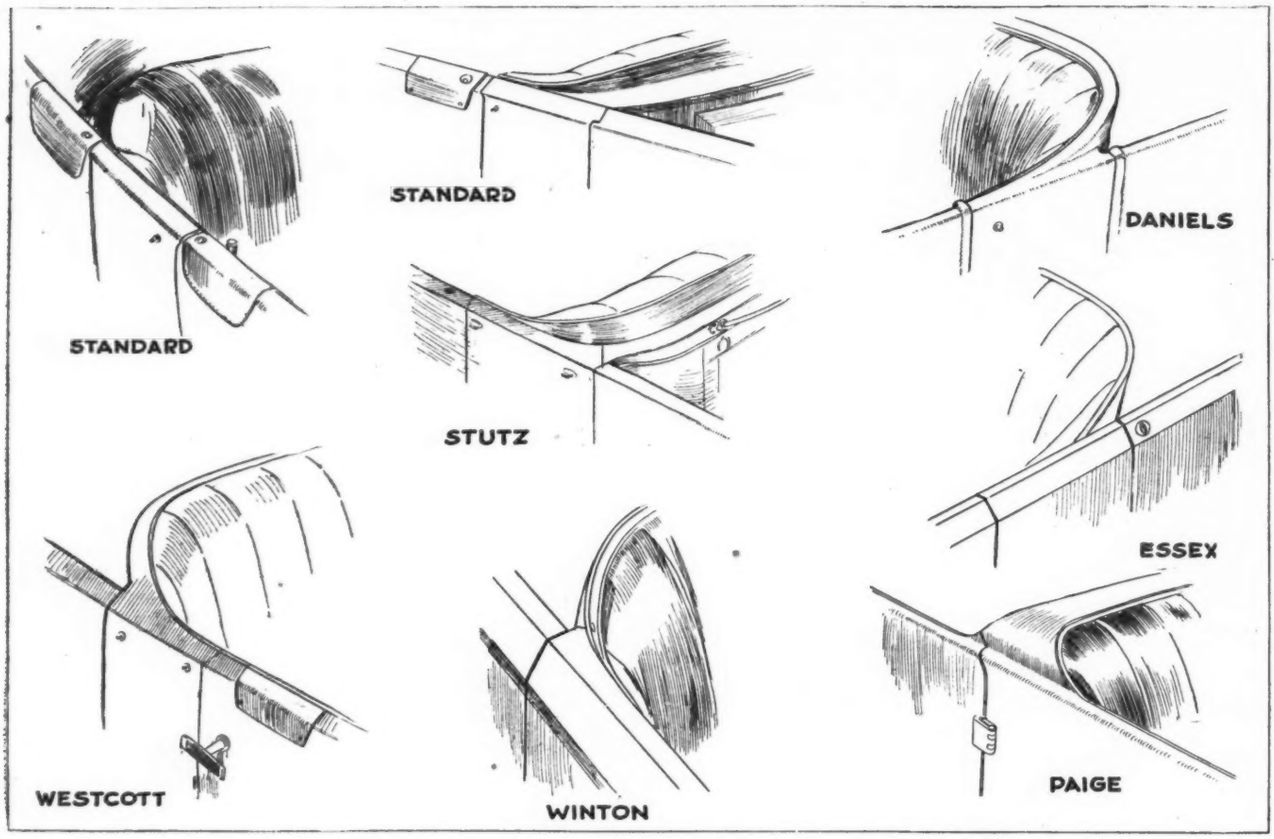
Although body sides are as low as is possible while retaining comfortable seating, the hoods and cowls are kept up, undoubtedly for the reason that it adds to the snappiness of the car when these parts possess a relatively good bulk. They then convey the impression that the motive power of the car is ample. There are instances, however, in which this idea is exploited to an excessive degree.

The hood at the dash must not be greatly higher than at the radiator; in fact, this line looks best when it slopes mod-



One way of treating bevel edges where they meet the front cowl

Another example, where the bevel is carried forward onto the hood



METHODS ADOPTED IN BLENDING THE CENTER COWL WITH THE BODY LINE

Good results are obtainable when the second cowl is a continuation of the bevel of the top line, but unless conditions are favorable it is difficult to make a perfect job

erately downward toward the front. This rule also holds good for the effect across the hood when the straight line of the body is continued forward to the radiator. The center of the hood does not look right when its height is accentuated above the corner line on the sides.

The advent of this small four-passenger body will result eventually in the disappearance of the four-passenger runabout types for the reasons that it is more sensible, more comfortable, is built on lines which are standard and is less subject to criticism as a freak.

A feature of interest is the great number of bodies without ventilators either in the sides or on top of the cowl. Many bodies are so fitted, but in many instances the lower part of the windshield is relied upon for ventilating the interior of the front part of the body.

An element favoring the sought-after low effect is the use of wire and disc wheels of 32 in. and 34 in. diameter. The former are strongly in evidence and are generally painted a light color. Disc wheels are numerous and look best when the disc part is painted a dark or solid color. This method reduces the size of the metal center and gives a better balance in appearance. One car is fitted with wheels having discs finished in nickel, which have the effect of making them appear too large in relation to the tire.

This latter instance tends to emphasize the fact that it is not always safe to apply conditions which are all right in a given place to another part without giving consideration to the effect. Nickel radiators look well, as do windshield frames and headlights, but when applied to wheel disks the result is not altogether happy. In this connection the accompanying illustrations show that the round Rolls-Royce type of headlight has many followers. These are usually finished in nickel and vary in size from the large type on the Rolls-Royce to those of average diameter.

There are plenty of good fenders. Those of the Packard and the Daniels show particularly well for the rear. They come well down and give the appearance of actually encircling the wheel. Brooks-Ostruk has one car with cycle fenders and steps without runboards. This body is on a Pierce-Arrow chassis with a new round-topped radiator. The body is a combination sport type on Rolls-Royce lines, attractive on account of its unusual lines and of excellent workmanship and finish.

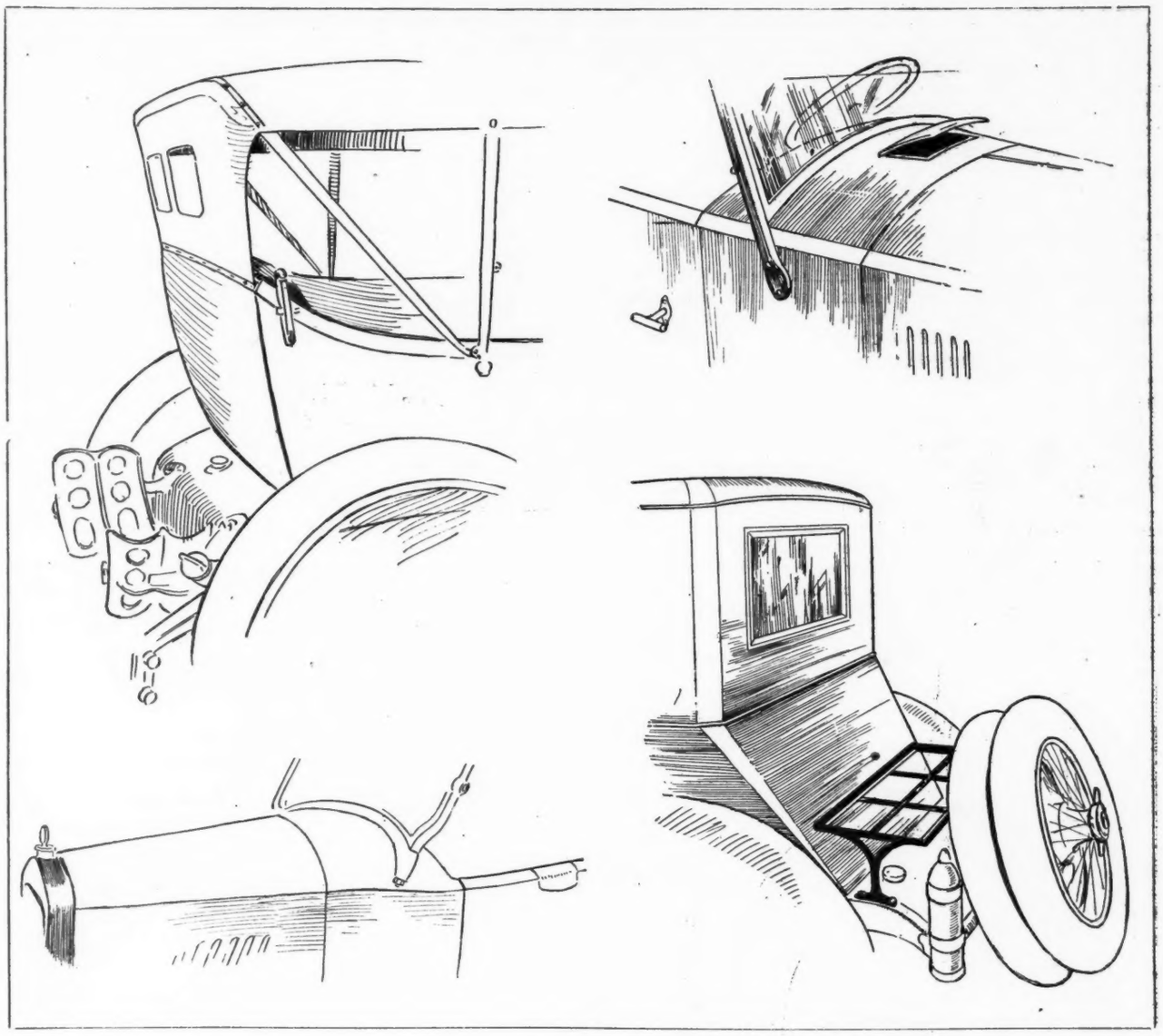
Louvres on engine hoods are long and narrow in many cases, and for the most part lack the exaggerated appearance of former years. A novel type is that of the Winton, the formation to make the louvre being inward instead of outward. Consequently the line of the hood side is flat on the outside, making a clean-looking piece of work.

Outside door handles are used to a considerable extent on open bodies, eliminating the use of pads on the door-tops to facilitate closing. Trimming of leather or wood for the top finish of the sides is used by but few, practically all having clean-cut lines of painted metal. The new design small touring body has an unbroken front seat, at the back of which a robe rail, generally a round leather strap, is fitted. Some bodies have step lights operated by the opening of the door. As these lights are located in the center of the back, one is sufficient for both doors.

Upholstery trimming remains unchanged from last year. In the great majority of cases the straight, stitched pleat, finished with welt and not showing noticeably above the back seat line, is the style affected. One or two exceptions show a single row of buttons.

Where one-man tops are fitted (and there are few special tops) the gooseneck attachment is quite conspicuous this year, coming completely above the trimming line. There are a few victoria tops. One National has a special shield with celluloid lights connecting the front of the top and closing the space from the back of the front seat. In addition this shield has side wings forming the corners and so hinged as to facilitate entrance or exit.

The Pierce-Arrow close-coupled body has a novel top with several good features. Ordinarily the one-man top has a cluster of bows which support it from the gooseneck, radiating from this center with the forward one of the group con-



Left, top—The flat back and square corners of the Essex tend to give the effect of a long body. Top, right —Treatment of the Essex body, showing continuation of bevel along cowl. The lower sketches show a method of connecting the body edge to the hood and a treatment which involves running out the body bevel to the rear

siderably ahead of its supporting point. On this individual body the forward bow is straight up and the quarter thus formed is closed with a curtain. This form of construction results in giving the job an excellent appearance.

The interior appearance of these open bodies gives an idea of comfort and the general appearance is in good taste and in conformity with the color scheme. For the most part, light colors prevail on open bodies, low-tone grays, coffee and black, green and cream under gear and black fenders are some of the combinations which look well.

As a matter of fact, all the color combinations are in good taste except the reds and the reds and yellows. These bodies look best in cases where, when two colors are used, the dividing line occurs at the chassis—that is, the body one color and the chassis and fenders another.

Painting the hood in two colors seldom looks well, the one "best" way of insuring a distinctive appearance being to have the radiator nickeled. If, in addition to this, the headlights and the windshield are also finished in nickel, the combination adds more snappiness to the car than all the paint in the world. Striping is used to some extent on the higher-priced cars, and it is worth its cost. It dresses up the painted surface and gives it a character that is appreciated when two cars, one striped and one without stripes, are placed side by side. There are but two cars with the dull finish paint which was common a few years ago. The majority have that varnished surface which shows off the shape and design of a body to the best effect.

Closed bodies include examples of all the jobs that have been on show in previous years, with the high-priced special bodies in larger number than ordinarily in proportion to the total exhibit. There are a number of attractive cabriolets, the large radius corner of the top at the rear being modified on quite a number. The designing of the top of the driving seat is better than usual. Brooks-Ostruck have a Rolls-Royce chassis with English line body, and Packard exhibits one with the modified roof corner. Holbrook shows a body with six fenders and steps. This is a sensible fender design, as it provides for the effective protection of the step by having a large flap hanging from the front fender.

The Marmon cabriolet possesses good color combination, and here it may be mentioned that the front seat cushion should always be divided as on this body. The reason for this is that it enables the driver to have his half built up to suit, leaving the other normal. Another reason is that in filling the tank or when gaining access to underneath the seat the half cushion can be laid over on the other side instead of being removed to the floor.

Only two of the town cars have pillar lamps, and there are but few dash or cowl lamps among all cars. It is true of closed bodies as of open that there are fewer ventilators in the cowls, windshields being made to do duty as ventilators to the front compartments. Windshields on enclosed cars are of regulation design. A few have double upper visors, but this is not generally the case.

There are several really good coupes. This body design is usually a factory standard and therefore does not come in the special design class. With the present trend for smaller bodies of all kinds it would seem that the small two or three-passenger inside drive body merits more attention than has been given it in the past.

Modern bodies of this kind are made with a window on the side, back of the door, and sometimes the division pillar is taken out and the entire side is open. As the top is so light, the criticism that the roof weight may break the pillars cannot be sustained against this type of body as may be the case with the large, seven-passenger jobs. Therefore it would seem that this type of body will become popular.

There is about the usual proportion of convertibles, identical in design with those of former years. The offset door type is the most popular of these, as it eliminates the necessity for crowding past the occupants of the rear seat.

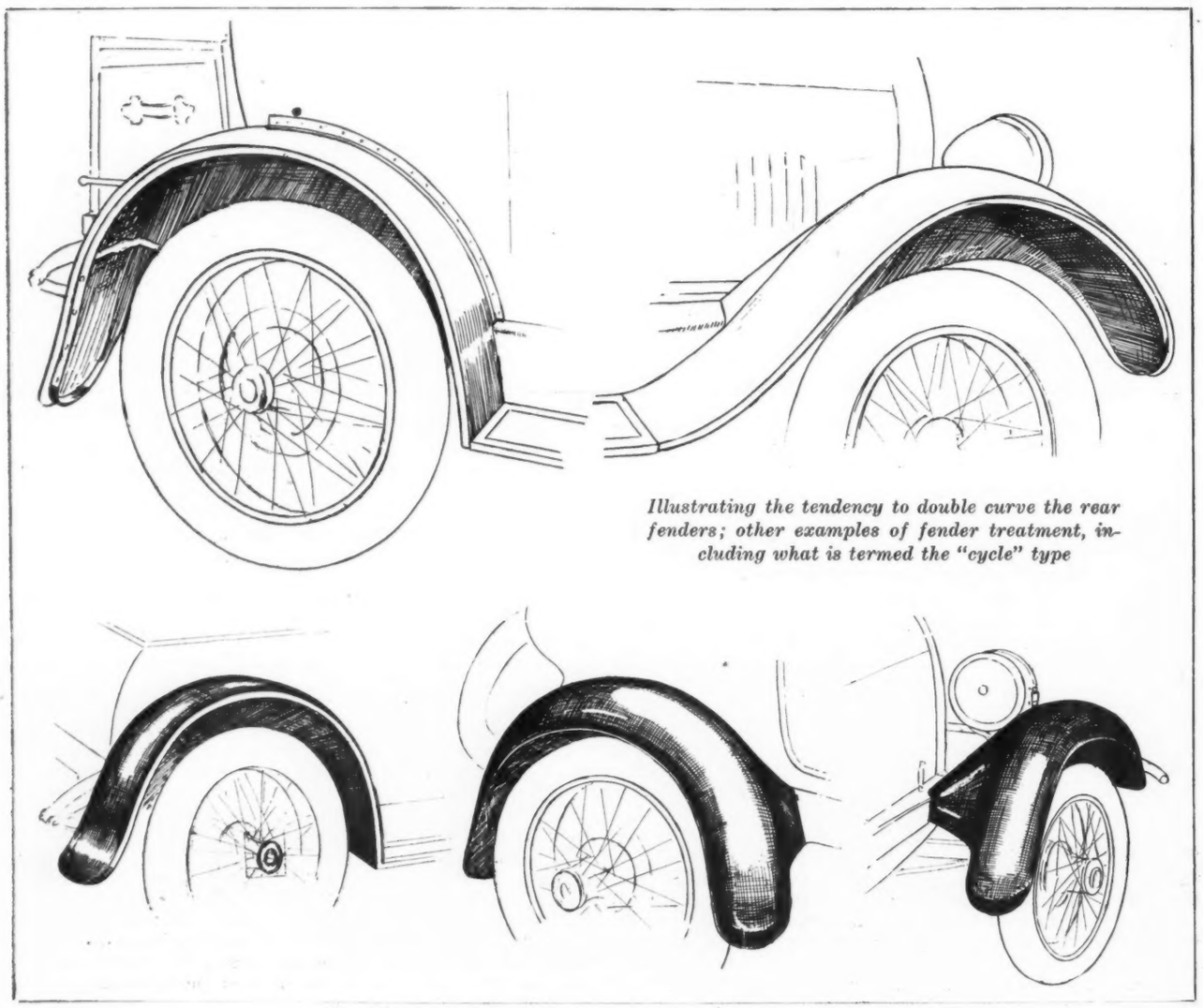
Wire wheels are used largely on closed as well as on open bodies. When wood wheels are fitted they are frequently painted a light color or given a natural finish, giving a light appearance to the car. Some few of the bodies have square rear corners, showing that the old horse-carriage style of body still has a faithful following. One closed body has cubist corners, a style which has had examples at shows for the past three years, but not in increasing numbers. It simply is different from the regulation line without being an improvement and it looks better when painted in light colors.

There are no new features in construction. In rare cases doors are made with tee mouldings, overlap panels covering the door openings in most instances. This is not generally considered the best practice, but it is the most practical, as it requires more careful workmanship to make the door flush and have a uniform opening all around. On the higher-priced body work the flush door is used, but the difference in the two methods is really more noticeable on open bodies than on closed types.

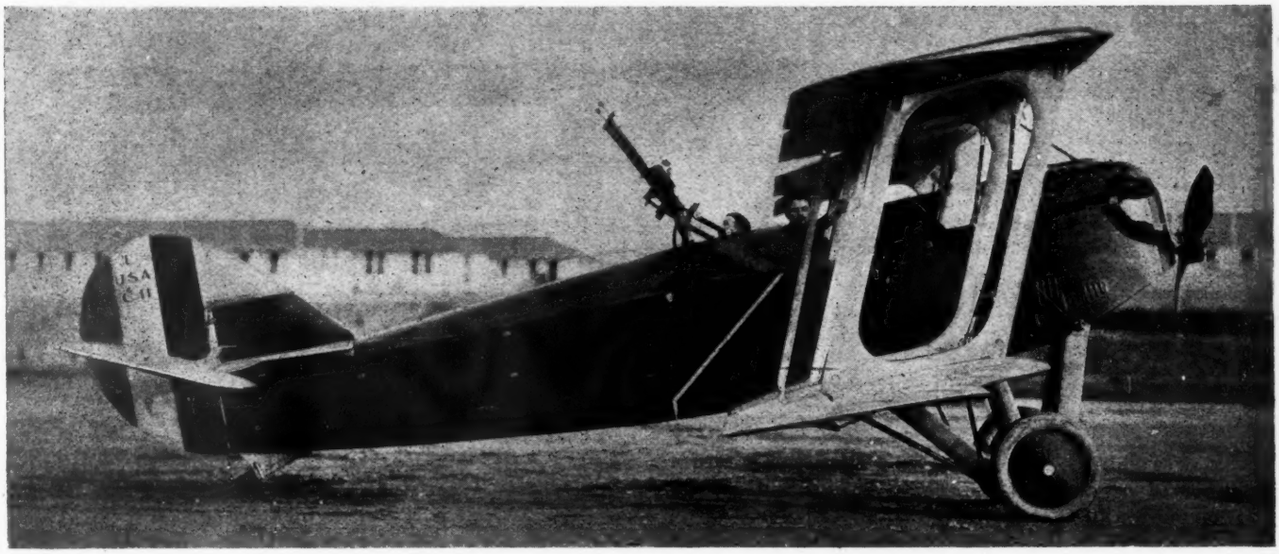
Trimming on closed bodies is plain in pattern and color of material. Quite a number use velour material of somber color. Plain pleats are used uniformly, with shaped arm rests for the rear seat and pockets on the doors.

Paint is uniformly brighter than usual and a few cars give evidence of an unfortunate selection of the dividing line for the changing from one color to another. When two tones are used on closed bodies the dividing line is best when horizontal and at the belt is best for most colors. One National sedan has a nice blending of two blues, using the belt and continuing the two colors on the hood and to the fenders. This made an attractive combination. A town body on which similar colors were used with a perpendicular dividing line was a less fortunate effort.

Striping is executed very nicely on many of the light blue cars, in some cases two colors being used for the striping as well as for the body.



Illustrating the tendency to double curve the rear fenders; other examples of fender treatment, including what is termed the "cycle" type



Side view of the Le Père plane showing continuous strut and machine gun mounting

Production of Le Père Planes Was Well Started

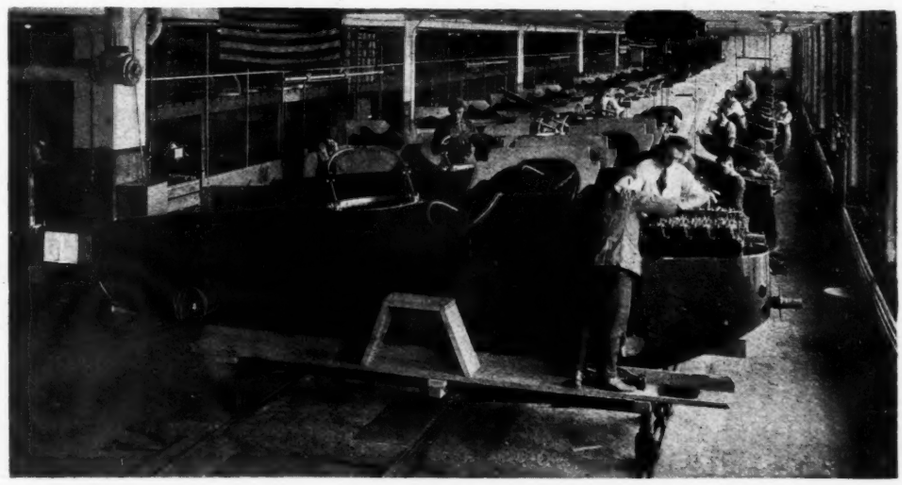
This Machine, Built in the Packard Plant, Is a Better Climber and Has a Higher Ceiling Than the D. H.-4— Excels in Detail Fittings

By J. Edward Schipper

JUST a few months before the armistice was signed Captain Le Père and the French Aviation Mission of which he had charge evolved a plane which is recognized to be the most efficient two-seated fighting machine yet developed. Frequent reference has been made to this plane in the columns of AUTOMOTIVE INDUSTRIES. The first 1000 planes had been started through production and a number of them were completed.

This plane, as developed by the French Mission, was purely a two-seated fighting machine, designed particularly for the Liberty engine. It was brought over here by the French Mission in embryonic form and then developed around the Liberty engine. As manufactured to date, this machine did not have a bomb-carrying or photographic attachment, being designed exclusively for fighting. It is in many respects an improvement over the D. H.-4. Owing to its lower weight—partly due to its construction and partly to the elimination of bomb-carrying and photographic features—it has a faster climb than the De Haviland and also a higher ceiling. It maneuvers better and it is also a better production job than any plane of its class.

A number of novel features, particularly as regards construction, appear in the design of this plane. These are apparent from the exterior photographs shown here-



Assembling Le Père planes at the factory of the Packard Motor Car Co., Detroit

Front view of the Le Père plane designed by the French Aviation Mission and built at the Packard factory, equipped with the Liberty engine

with. Probably the most noticeable feature is the new type of strut construction, in which a continuous unit is employed to form the front and rear members of the strut. This is a naturally rigid form of construction, and one which increases the strength without interfering with the streamline construction. A considerable stagger is used, which gives a much greater range of vision than is obtained on the D. H.-4.

The machine-gun mounting is the same as that used on the D. H.-4, but the seats for the pilot and observer are so located as to concentrate the weight of the passengers and powerplant, thus increasing the maneuvering qualities of the plane to a marked extent. Captain Flachaire, the noted French ace, who was in this country during the past summer and fall, stated that this machine was one of the best to handle that he had ever driven. He was able on his first flight to put it through a series of flying feats which are generally possible only with a smaller machine.

This plane is also faster than the D. H.-4, which is probably due to the better streamlining. Some credit for the better performance is given to the stagger of the wings, but this is not fully settled. The plane has exactly the same wing area as the D. H.-4, although the load distribution is entirely different.

On the sand test this machine shows a factor of safety of eight. The spruce veneer work is unusual, particularly as regards the landing gear, which may be seen from the illustrations of the plane herewith. This plane excels in its detail work, and the fittings are particularly well designed. The inter-strut bracing fittings are very strong and yet do not break the streamline of the wing surface.

The plane was developed by the French Aviation Mission and was being built at the factory of the Packard Motor Car Co.

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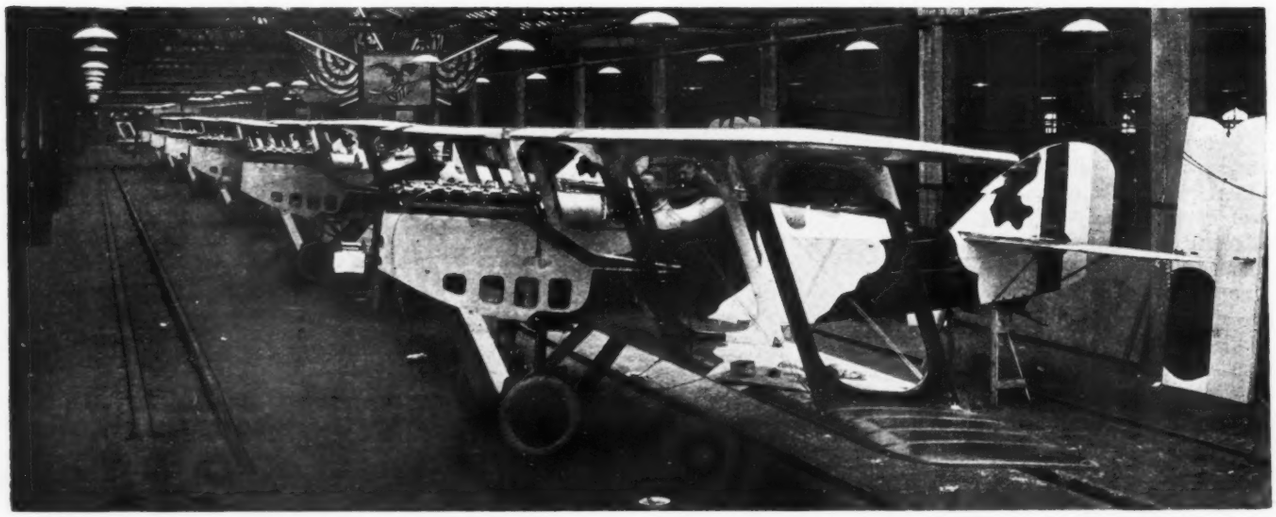
Performance of British Airplanes

MANY new types of airplanes were developed in Great Britain during the war, designers constantly striving to produce machines that would excel those of the enemy in performance. This necessitates constant experiment and alterations, and complaint was sometimes heard that production was seriously interfered with. The following table shows the performance of the leading British types. (At lower altitudes the machines will, of course, develop higher speeds):

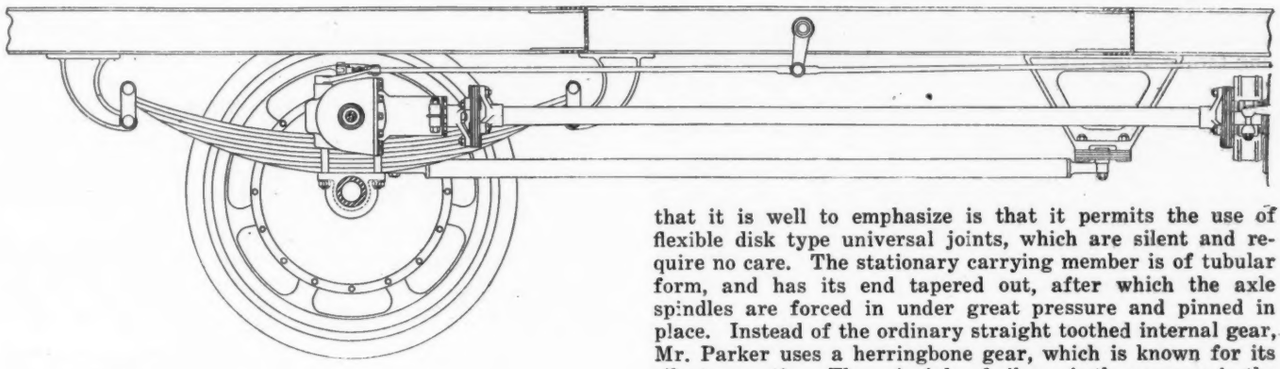
Machine	Speed at 10,000 ft.	Time Required to Climb 10,000 ft., minutes	Continuous Flight Capacity, hours
F.E. 2B	76	40	3½
Vickers Fighter	76	40	3½
Sopwith 1½ Strutter	103	10	...
Bristol Scout	111	10	1¾
A.W.	88	27	3
Sopwith Camel	118	10	2½
D.H.-4	120	11	4
D.H.-9A	120	11	6
Bristol Fighter	113	11	3
S.E.-5A	126	10	3
Dolphin	128	8¼	1¾



Final steps in assembling the Le Père plane at the Packard factory

Parker Silent Internal Gear Axle

Internal Gear Completely Inclosed and Running in an Oil Bath—Raybestos Disk Brakes on Driving Shafts—High Ground Clearance and Ready Accessibility Features



ONE of the great engineering problems of the times is that of the best final drive for commercial motor vehicles. For passenger cars the bevel gear drive is now about universal, but for commercial vehicles some form of double reduction must be used, unless resort is to be had to the worm drive. Whatever the ultimate type of final drive may be, there can be no doubt that it will be noiseless in operation and completely inclosed, so as to permit of effective lubrication and the exclusion of dust and grit from its bearing surfaces.

It is the attainment of these two qualities—silent operation and thorough inclosure—which has been aimed at particularly in the design of a new truck axle just brought out by the Parker Axle & Products Corporation of New York, of which Clark W. Parker is the organizer. The Parker axle is of the internal gear type, but it differs in almost every detail from previous axles of this class. Like other internal gear driven axles, it comprises a stationary carrying member, and a driving member supported thereby, carrying at its ends the pinions meshing with the internal gear rings on the wheels themselves. While in all, or at least nearly all, previous internal gear driven rear axles the driving member has been located either in front of or behind the carrying member, in the Parker axle it is located on top of it, the object of this change from conventional practice being to secure a straight line drive.

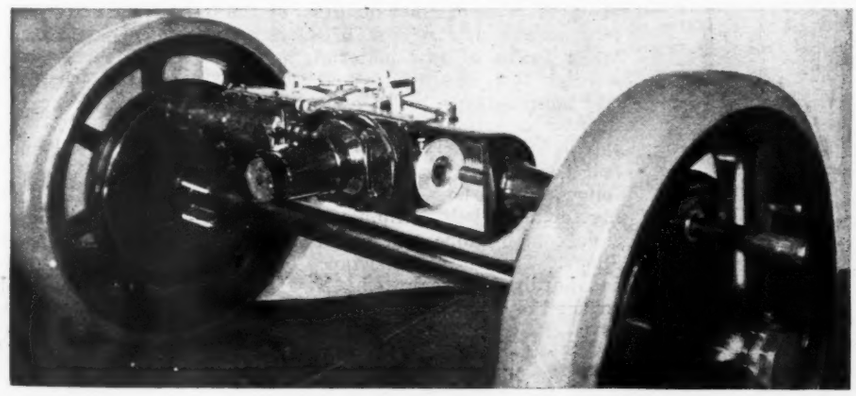
It is not necessary here to dwell upon the advantages of the straight line drive, as they are well known, but one point that it is well to emphasize is that it permits the use of flexible disk type universal joints, which are silent and require no care. The stationary carrying member is of tubular form, and has its end tapered out, after which the axle spindles are forced in under great pressure and pinned in place. Instead of the ordinary straight toothed internal gear, Mr. Parker uses a herringbone gear, which is known for its silent operation. The principle of silence is the same as in the well known helical gears now so much used for camshaft operation, but the herringbone gear has this advantage over the helical gear that it does away with end thrust in the shaft.

In former designs of internal gear driven axles, the gear reduction has been obtained in two steps, a first reduction at the center of the axle and a second one by the internal gear sets at the driving wheels. Mr. Parker uses a pair of miter gears at the center of the axle and obtains his whole reduction by the internal gears at the wheels. This makes the driving member of his axle a comparatively high speed device and permits of using a small differential and small axle shafts.

Oil Cooled Disk Brakes

The most striking innovation in the new axle is the brakes. These brakes are of the disk type, and are located on the differential shafts. The brakes comprise an internally splined drum which is securely held in the housing of the driving member and an internally and externally splined sleeve, which is in driving connection with the differential shafts. One set of metal disks is threaded upon the splined sleeve, and the other is threaded into the splined drum. The metal disks are not the ordinary flat disks, but are of composite construction, comprising two flat disks separated by a radially corrugated disk, which affords passages for oil from the center of the brake to the outside. Between the metal disks are located Raybestos disks, which may either be secured to one set of the metal disks or allowed to float.

The brakes are engaged by compressing the disks endwise, or in an axial direction. To this end the innermost disk is provided with a tubular extension formed with a groove for the shifting collar. The brake operating mechanism is of an ingenious design, combining a toggle device for multiplying the effort of application and an equalizing device, by means of which the pressure is equally divided between the two brakes. The toggle links are in the form of turnbuckles, and permit of quick adjustment of the brake linkage. A coiled spring acting at the center of the toggle moves in a guide slot, which prevents one of the brakes from being engaged automatically when the truck slopes sideways. It is, of course, necessary



Three-quarter view of Parker axle

to keep the toggles adjusted in such a way that the guide pin enters the slot substantially centrally. Not only is this adjustment very easily accomplished, but there should be very little occasion for readjusting the brakes, as the latter have an enormous surface in proportion to the work they have to do, and the oil circulation which is maintained also tends to keep down heating and wear.

For radial bearing loads, use is made in the Parker axle of Hyatt flexible roller bearings, while in points where thrust loads are to be taken care of the New Departure double row bearing is used.

Hollow spoke cast steel wheels are a distinguishing feature of the Parker internal drive rear axle. These wheels are demountable, being bored out to a considerable taper, and forced over a corresponding taper of the wheel hub, the driving torque being taken on a key. The wheel hub is mounted on a Hyatt roller bearing at the inner end, which is not far from the central plane of the wheel, and on a New Departure ball bearing at its outer end, this latter acting as a steadying bearing. Cast integral with the hub is a driving flange to which the internally toothed driving gear ring is riveted. The gear ring being riveted directly to the driving flange on the wheel hub, insures a very rigid support, and continued perfect mesh of the gears.

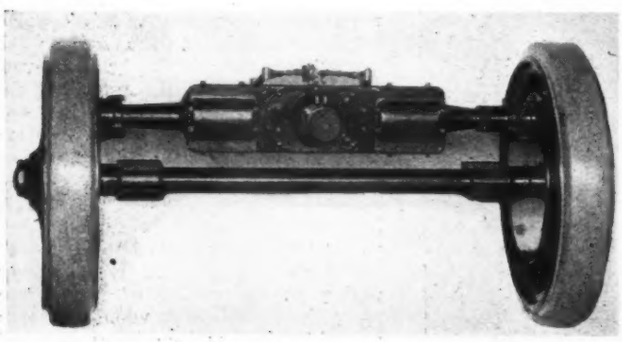
Gears Completely Inclosed

The internal gear ring is surrounded by a housing formed in two parts, of which the part away from the wheel is a casting which also forms the bearing support for the differential shaft. The part close to the wheel is a sheet metal stamping which is flange-bolted to the cast part, and which closely follows the outline of the driving flange carrying the internal gear ring. This sheet metal housing at its inner edge is formed with a groove for packing material, insuring a dust-tight joint with the revolving wheel hub.

A most interesting feature of the axle is its circulating lubricating system. A certain amount (about a gallon) of lubricating oil is carried in the gear housing. Mr. Parker figures that at a truck speed of 5 m.p.h. the centrifugal force on the oil is sufficient to carry it around with the gear ring. The differential shaft is made hollow from the wheel end to a point where the brake is located and the oil will be forced through this shaft by the centrifugal effect upon it. At that part of the shaft where the splines for the disk brakes are located, a considerable number of radial holes are drilled in the shaft. The oil will be forced through these radial holes and by the centrifugal action through the spaces in the composite disks of the brake. After having passed through the brake, it collects in the housing of the countershaft, and when it reaches a sufficient level, it returns to the housing of the internal gear ring, a channel for its return being provided in the bearing hub of the differential housing.

Oil lubrication not only is more efficient than grease lubrication, but eliminates the need for a lot of attention usually required by a truck. On the Parker axle there is not a single grease cup or oil cup to be looked after. The only attention required by the lubricating system is that involved in the replenishment of the oil supply once or twice a year.

Special attention has been paid in the design of the Parker axle to requirements of accessibility and quick adjustment. The housing of the live axle shaft, within which the brakes are located, is provided with two cover plates on the front side, which can be removed quickly, and permit of the withdrawal of the whole brake. It is Mr. Parker's intention to provide these cover plates with small inspection holes, so that it is not necessary to remove the cover plates when it is merely desired to inspect the brakes. In order to permit of the removal of the brakes, the live axle shaft is made of floating design. There is a small covered opening in the gear housing opposite the shaft end, and when it is desired to remove the shaft, the wheel is first turned until this opening is between two adjacent spokes. Then the small cover plate is removed, and a screw inserted into the end of the axle shaft, by means of which it can be readily withdrawn. Next the covered plate on the housing of the countershaft is removed and four bolts, which hold the stationary part of the brake in position, are taken out. After this, the whole brake can be bodily removed from the axle.



Housing of live axle shaft, showing the two cover plates on front side

In addition to the rear axle disk brakes, which act as service brakes, the Parker axle will be provided with an emergency brake, which will be secured to the shaft of the driving bevel pinion, where it enters the rear axle housing.

Not the least of the advantages of the Parker axle is the high ground clearance it affords. With 36 in. wheels, more than 16 in. clearance is obtained, and this clearance extends from wheel to wheel, as the gear housings are entirely within the wheel.

The Parker Axle & Products Corporation has only recently been incorporated, and will immediately begin operations. The first axle design is a 2-ton type and embodies the Hotchkiss drive principle. The spring pads are formed integral with the hub of the driving gear housing on which the torque reaction comes, consequently the torque is transmitted to the rear springs in the most direct way possible.

Owing to the fact that the weight carrying member of the axle is of tubular form, and that the countershaft operates at high speed, the unsprung weight is comparatively small. This is of importance on account of the effect of the unsprung weight on tire wear. The cast steel wheels are of Mr. Parker's own design. Owing to the principle of detachability involved, the customer can be given an option between single pneumatic, twin pneumatic, single solid, twin solid and plain steel rim wheels, all being interchangeable.

Coming Developments in the German Iron Industry

HOW German engineers and manufacturers propose to deal with the new difficulties of industry consequent on the war is shown by the report of the managing director of the Iron Founders' Association read at the general meeting in Berlin on Sept. 14 last:

The report says in effect: The scarcity of raw materials will continue far into the years of peace. We must, therefore, prepare for an intensive use of materials and human intelligence. With our instructive experience in wartime in mind, we must apply the latest scientific knowledge to the problems before us, to smelting, casting and cooling, and to the production of other qualities by the use of new alloys, and new means arising out of increased chemical knowledge. Other forms of raw material, more economical methods of burning fuel, improved construction of furnaces, more effective temperatures, these invite research and suggest progress in new directions. The Kaiser Wilhelm Institute for research in iron has been founded to deal with these problems, and a sister institute for research in other metals is soon to follow. From both these the iron founders' industry is hoping for much help. Aluminum and zinc in their various possible combinations will replace copper and nickel and their alloys. The future importance of these metals for Germany can hardly be over-rated. New forms of construction will reduce the consumption of the rarer metals for certain parts of machines. The iron founder will look to the chemist to remedy the evil of a lack of hematite. A number of German blast furnaces are already prepared to use the phosphorus-free ores of Scandinavia and other countries in place of the supposed indispensable hematite.—*Giesserei-Zeitung.*

Standards Committee Acts on Division Reports

New Ball Bearing, Electrical, Engine, Spring, Tire and Rim and Miscellaneous Standards Recommended—A Few Items Referred Back to the Divisions

EIGHT divisions of the S. A. E. Standards Committee presented reports at the meeting of the Committee held on Tuesday, presided over by Chairman B. B. Bachman. Most of the reports were accepted after little or no discussion, but considerable opposition was raised to the adoption of certain recommendations and some of the latter were referred back to the divisions. It must be understood that any recommended standard reported as adopted in the following is not yet an S. A. E. standard; before it reaches that state it has to be passed upon by the Society at the general meeting, by the Council and, through the instrumentality of a letter ballot, by the entire membership.

The first report read was that of the Ball and Roller Bearings Division, by Division Chairman F. G. Hughes. In this it was pointed out that with the broadening application of ball bearings it had become advisable to extend the Society's standards to include both larger and smaller bearings, and the Division had prepared tables of dimensions for both types.

Extra Large Type Ball Bearings

In the extra large types it was considered desirable to standardize series of sizes with dimensions progressing proportionately, as far as possible without conflicting with current practice. It appears that certain sizes of extra large ball bearings have already been put in production, but it is felt by the division that changes can be better made now than after these large size bearings have become more firmly established. The tables of extra large types recommended contain only the bores and outside diameters, leaving the widths and all tolerances to be decided on later. An extra small series of ball bearings are also recommended, these being intended for use in airplane sheave pulleys and special apparatus. The report also contains dimensions of separable (open) type bearings which are extensively used in magneto construction and other small types of machines. That part of the report dealing with the extra light series of ball bearings was intended as a progress report only and not for action by the Standards Committee at this time, as difficulties had been encountered by the Division in discussing the width of the bearings and further consideration was necessary.

An angular contact bearing is also dealt with in the report, and the recommendation is made to standardize this in three series, heavy, medium and light, the same as the regular annular ball bearings. It will not be necessary to print special tables of dimensions for this type of bearing, but instead the following note is to be appended to the tables of the regular annular bearings: "Ball bearings of the angular contact type are identical in sizes and boundary dimensions with S. A. E. Standard annular ball bearings in the light, medium and heavy series, as printed on pages 29, 29a, and 29b, S. A. E. Handbook, Vol. I."

Roller Bearing Majority and Minority Reports

Mr. Hughes stated that at the Dayton meeting of the Society a special sub-division on roller bearings was appointed, which had held many meetings since. All of the members of this sub-division with one exception signed a majority report to the Division recommending that the present S. A. E. standard roller bearing sizes, which are metric sizes, be retained. A minority report was made by Mr. Porter, of the Timken Roller Bearing Co., who was chairman of the sub-division, this report being to the effect that the Timken company would reduce the present number of sizes to make an acceptable inch standard. Mr. Manly made reference to a matter in connection with ball bearing manufacture which had given him a great deal of trouble. This was that the chamfer specified at the corners of the inner and outer races was put on during the machining operation and before the final grinding, with the result that when the races were ground the chamfer was reduced in amount. Assurance was given that this matter would receive the attention of the committee.

High Speed Ball Bearings for Aero Work

President Kettering of the S. A. E. called the attention of the Division to the fact that there would shortly be a demand for ball bearings for aeronautic work to run at very high speed, as from 13,000 to 18,000 r.p.m. These bearings were required in gyroscopic compasses and similar apparatus. A motion was made that the Division be requested to investigate the subject of such bearings, and was adopted, but it was later on pointed out by Chairman Hughes that past experience had shown that the Standards Committee must limit itself to standardizing the outside dimensions of bearings. No end of trouble was encountered if it was attempted to standardize the internal construction, as the Committee did not possess equipment for carrying on the necessary research work.

That part of the Committee's report which was presented in completed form, including a table of dimensions for annular ball bearings of the separable (open) type, the extra small series and the angular contact type, was adopted by the Committee.

W. F. Cole presented the report of the chain division. The only recommendation made to the Standards Committee, a matter of nomenclature, was that the standard roller chain designation be changed from "Universal No." to "Manufacturer's Standard No." This was adopted.

Sleeve Mounting for Generators

The report of the Electrical Equipment Division dealt with four items, viz., a sleeve type of starting motor mounting, cable terminals for ignition distributors, generators, meters and switches, non-magnetic magneto shims and flexible disk magneto couplings. There had been some criticism of the proposal to add another mounting to those already standardized by the Society, but it was pointed out that the machining operation for a flange mounting on the flywheel housing of a unit power plant was often a very difficult matter. The mounting recommended is already in practical use. Mr. Broege wanted to know whether the relation of the new mounting to the engine was the same as that of the corresponding flange mounting and was told in reply that it would be quite possible to use a new starting motor (that is, one designed for sleeve mounting) on an engine designed for the flange mounting, using the same flywheel and a suitably designed adapter. The proposed mounting was adopted by the committee. This mounting is to be used only for outboard mesh installations, as it is not considered a suitable type for inboard constructions. The mounting consists of a cylindrical portion of the gearshift housing sliding into a bored hole in the bell-housing, the length of which is about two-thirds the diameter of the bore. The motor is locked in position by a screw through the bell housing entering a tapered

hole in the cylindrical portion of the gearshift housing.

The next subject dealt with in the report, that of cable terminals, was referred back. In regard to non-magnetic magneto shims, which subject was taken up last year, the Division now recommended that when it is desired to use a non-magnetic shim with magnetos mounted on cast iron pads, the shims shall be ½ in. thick, and high strength bronze bolts shall be used. The thickness of the shim is to be added to the dimension given in the mounting drawing for the distance from the face of the mounting pad to the center of the magneto shaft. It is suggested that a grid construction be used for the shims. This recommendation was adopted.

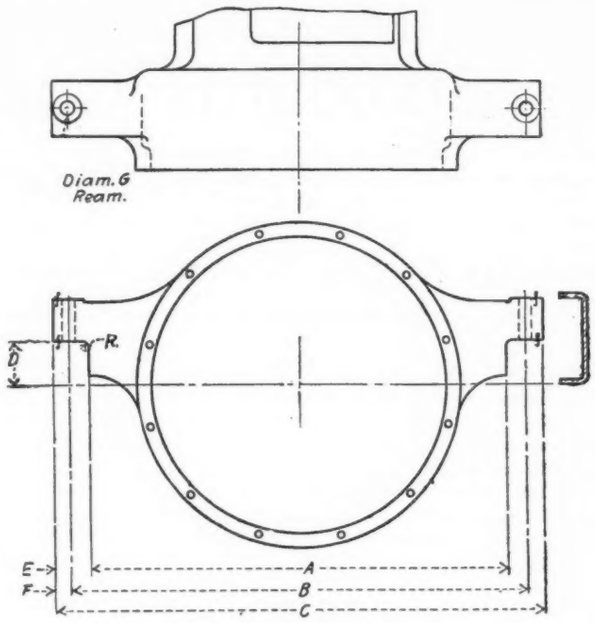
Dimensions are also recommended for flexible disk type magneto couplings, as follows: Outside diameter of disks, 2¾ in.; inside diameter of disks, 1 in.; diameter of bolt circle, 2 in.; thickness of disks, ¼ in.; number of ¼ in. bolts equally spaced, 4. These recommendations are complementary to the driving shaft and coupling dimensions printed in the S. A. E. Handbook, Vol. I on pages 36 and 36xa. This recommendation was also adopted.

Engine Support Arms

W. A. Frederick read the report of the Engine Division, which made recomendations regarding standard engine support arms in two sizes, the large size for the No. 1 S. A. E. flywheel housing and the small size for Nos. 2, 3, and 4 S. A. E. flywheel housings. It was pointed out that further standardization to include the front rocker bearing is being considered by the Division. The standards recommended correspond to the dimensions of the engine support arms on the Class B and Class AA Army trucks, respectively.

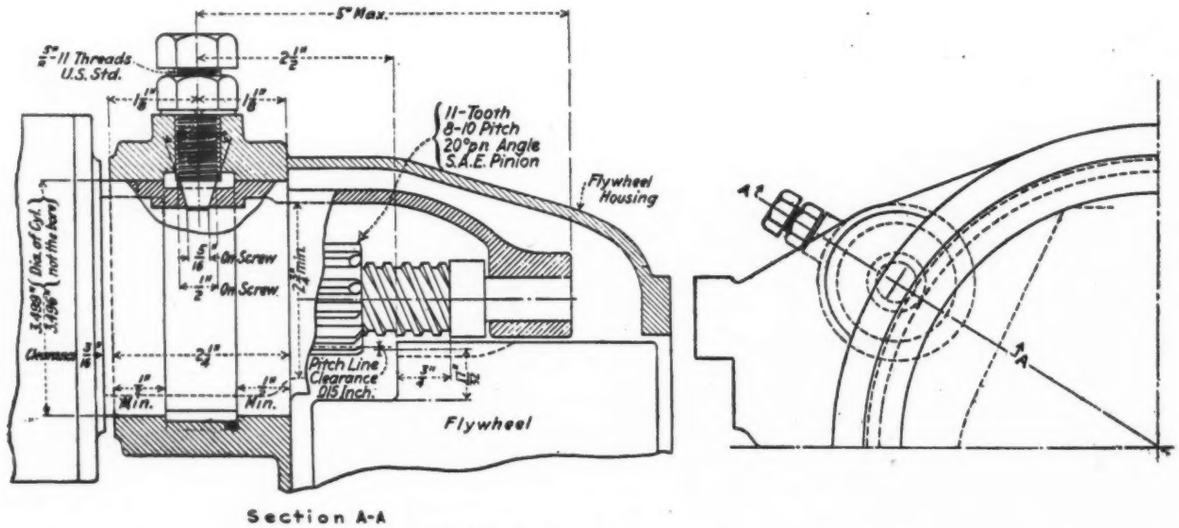
A letter from A. L. Riker was read in which objection was made to the adoption of the proposed standard. Mr. Riker said that the mounting suggested would not permit of supporting the engine direct on the main frame but called for the use of a sub-frame and its adoption therefore would favor sub-frame mounting. Replying to Mr. Riker's criticism, Mr. Frederick pointed out that the support was intended for both passenger cars and trucks. It had been found entirely impossible to standardize support arms for mounting engines directly on the main frame as the height of the engine relative to the frame varied considerably and so did the widths of frames. The arms could be used for mounting the engine on a sub-frame, or if main frame mounting was preferred, engine support brackets would have to be used. The report was adopted as presentd.

F. P. Gilligan read the report of the Iron and Steel Division which contained a suggestion for a new steel castings standard. The Society already has a standard for the composition of steel castings and the adoption of the new specification would amount to a revision of the old standard. The recommendation was made with the desire of correlating the several existing steel casting specifications which differ but slightly from each other. The A. S. T. M. specification has already been practically adopted by the Ordnance Department, the Navy and the Steel Founders Society of America. The recommendation was to the effect that the carbon in steel castings might vary as required in view of the physical properties demanded, but that the phosphorus and sulphur contents should not exceed 0.05 per cent each. There was a footnote attached to this specification reading as follows: "In view of the abnormal difficulty in obtaining materials in time of war, the rejection limits for sulphur in all steels and for phosphorus in acid steel shall be raised to 0.01 per cent above the values given in these specifications. This shall be effective during the period of the war and until otherwise ordered by the Society." The report also contained notes and instructions referring to the material specified, but it was not intended that these should form part of the standard itself.



Engine rear support arms

S. A. E. Flywheel Housing	A	B	C	D	E	F	G	R
No. 1	23½	26¾	28¾	2	2⅝	1	0.750	7/16
Nos. 2, 3 and 4	23⅛	24½	25¾	2½	1 9/16	⅝	0.625	⅜



Sleeve mounting of generators

The suggestion to permit a higher percentage of phosphorus and sulphur in steel castings elicited considerable discussion, automobile engineers uniformly holding to the opinion that an additional amount of sulphur would be very objectionable, whereas the steel men present claimed that it had never been proven that sulphur had the deleterious effect on steel which it was generally imagined to have. Mr. Reese said that the matter of sulphur in steel was not so much dependent upon war conditions as upon fuel conditions. Natural gas and coal low in sulphur had practically disappeared and we could not look forward to a reduction in the sulphur content permissible. The manufacturers of steel felt that the conditions had not improved in the least. The Navy even allowed up to 0.08 per cent sulphur in steel castings.

Steel Castings Report Referred Back

In the discussion it was pointed out that the majority of steel castings used in the automotive industries were now made in the electric furnace and that there was no difficulty in keeping down the percentage of sulphur and phosphorus in this process. For steel castings made by the open hearth process 0.06 per cent would be a very fair limit. After an extended discussion and in view of the fact that the American Society for Testing Materials will probably take up the matter at its meeting in March, the subject was referred back to the Division for further consideration.

E. H. Ehrman presented the report of the Miscellaneous Division, which comprised two items, namely, nuts for machine screws and aeronautic spark plug dimensions. Some opposition was made to the adoption of the recommendation for nuts for machine screws in a letter from former Standards Manager W. M. Hanks, who is now connected with the Navy in the capacity of aeronautical engineer. Mr. Hanks' objection was that these nuts, while in general corresponding to the S. A. E. standard hexagon nuts for aeronautic work, did not absolutely agree therewith and that this would lead to confusion. Mr. Hanks considered the adoption of this new standard an unnecessary multiplication of nut standards. In reply to this letter, Mr. Ehrman explained that there was a great difference between the nuts for machine screws here considered, which were generally manufactured by punching, and the S. A. E. standard nuts for aeronautical work which were produced from bar stock. There would not be the least interference between the two, and, in fact, the nuts for machine screws covered by the suggested standard were already being manufactured and the standard had the support of all of the machine screw makers of the country. One important difference between the nuts for machine screws and the S. A. E. standard nuts for aeronautic work was that the tolerance in the former was so great as to render them entirely unsuitable for aeronautical work. The table of dimensions recommended gave only the outside dimensions, and Mr. Ehrman stated that this standard would not be affected by any action that might be taken by the Commission for the Standardization of Screw Threads. Mr. Howard made the suggestion that the long diameter of the square and hexagon should be given in the table, but Mr. Ehrman thought it preferable that a table of long diameters of squares and hexagons should be published somewhere else in the S. A. E. Handbook. This part of the report was adopted.

Standard Nuts for Machine Screws

Thread Diameter No.	Decimal	Short Diameter	Nominal Thickness
0†	0.060	1/8	0.055
1†	0.073	5/64	0.055
2	0.086	3/32	0.055
3	0.099	7/64‡	0.074‡
4	0.112	1/8	0.094
5	0.125	9/64‡	0.094‡
6	0.138	5/32	0.101
*			
8	0.164	11/64	1/8
*			
10	0.190	3/16	5/32
12	0.216	7/32	3/16
14	0.242	1/4	7/32
*			
18	0.294	5/16	1/4
20	0.320	11/32	1/4
*			
24	0.372	13/32	5/16
*			
30	0.450	15/32	3/8

*Intermediate sizes are special—7, 9, 16, 22, 26, 28. Their dimensions are the same as for—6, 8, 14, 20, 24, 24.
†Made from bar stock only.
‡Unless made from bar stock, No. 3 and 5 will be made the same dimensions as No. 2 and 4 respectively.
Table gives all stock sizes for square and hexagon machine screw nuts of brass, iron and steel.

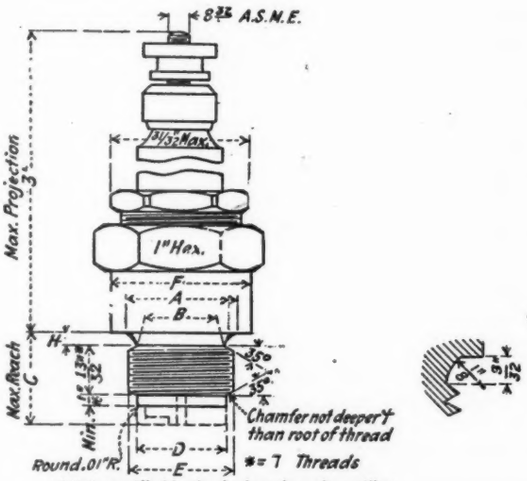
Aeronautic Spark Plug

A few changes were made in a dimension drawing of the aeronautic spark plug submitted. The aeronautic spark plug had been standardized already and the present recommendations are in the nature of a revision and an extension of the former standard. If adopted, the S. A. E. aeronautic spark plug will be brought into harmony with the international standard, and spark plugs of American origin will be applicable to British engines, for instance. In the design submitted slip terminals were shown for plugs for both stationary engines and rotary engines. Some objection to the design of the slip terminal was made by Mr. Crane, and as a result this part of the recommendation was referred back to the committee. The rest was adopted.

W. M. Newkirk read the report of the springs division which embodied quite a number of items, some of them intended for action by the Standards Committee at the meeting and others merely to indicate progress made. The first item had reference to leaf points. Two drawings were shown in the report, one of them showing leaf points which had been used in the past but now practically obsolete, and the other showing leaf points which are in common use to-day. It was decided by the Division, just before the meeting, to withdraw the first drawing and recommend the inclusion of only the latter in the records of the Society.

Leaf points Nos. 2, 3 and 4 are suitable for rolled tapered leafs and leaf points Nos. 4 and 5 are suitable for full thickness leafs. Rebound clips are to be used in all cases.

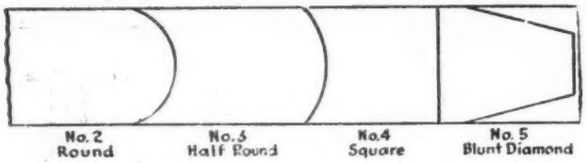
The present 3/16 in. value for angular variation of the eye center line is considered too close for practical vehicle spring



	A	B	C	D	E	F	H	
INCHES	.728 .709	.633† .625	5/8	.625	.708 .703	31/32	3/32	MAX. NOM. MIN.
M.M.	18.5 18.0				17.97 17.85		●	MAX. MIN.

DIAMETERS	Spark Plug Thread M.M.	Spark Plug Thread INCHES		Tapped Hole M.M.	Tapped Hole INCHES	
OUTSIDE (FULL)	17.975 17.850	.70768 .70275	(.708) (.703)	18.312 18.187	.72095 .71603	(.721) (.716)
PITCH (EFFECTIVE)	17.001 16.876	.66933 .66441	(.669) (.664)	17.176 17.051	.67622 .67124	(.676) (.671)
ROOT (CORE)	15.864 15.739	.62457 .61964	(.625) (.620)	16.201 16.076	.63783 .63291	(.638) (.633)

Aeronautic spark plug



New leaf points

tests, and the Division recommends that this be specified as ⅜ in. both ways for commercial vehicles, as shown in the accompanying drawing. The tolerances now specified for eye bushings and bolts are considered too close for practical application, and it is recommended that they be opened up to within commercial limits as follows: Bushed eyes—plus 0.001, minus 0.003; bolts for bushed eyes—minus 0.005, minus 0.008; unbushed eyes—plus 0.001, minus, 0.004; ground bolts for unbushed eyes—minus 0.006, minus 0.009; bolts of hot rolled stocks (not ground) for unbushed eyes—diameter minus 0.004, for maximum so as to use standard reamers.

An attempt was made to refer the recommendation regarding telerances for spring parallelism back to the committee, but the motion was lost.

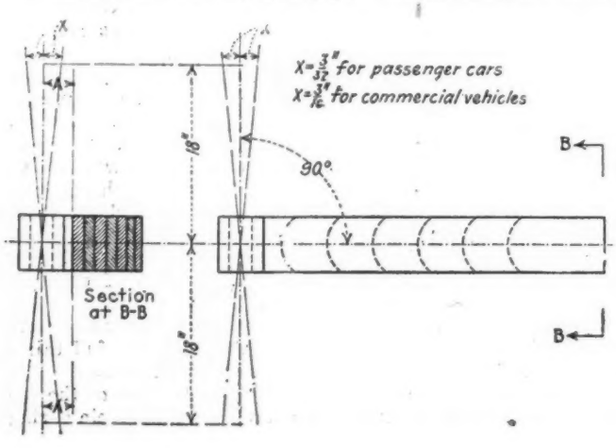
The Division also recommended that a paragraph in the S. A. E. Handbook reading, "The second leaf should not be wrapped around the eyes of passenger car springs," should be omitted. The effect of this is to broaden the provision of double wrapping, making it applicable to all kinds of springs.

In connection with the width of spring ends it was recommended that the tolerance be changed to 0.005 in. for passenger cars and 0.010 in. for commercial vehicles. In connection with frame brackets, the passage in the Handbook relating to this is to be extended to read: "the distance between the ears of bracket hoods should be 0.010 in. greater than the finished width of the spring eyes, with a minus tolerance of 0 and a plus tolerance of 0.005 in. for passenger cars. For commercial vehicles the minus tolerance should be 0 and the plus tolerance 0.010 in." A note is to be added to an item on rebound slips, spacers and bolts in the Handbook to the effect that "clearance between the rebound clip bolts (or spacer tubes if used) and spring plates shall not exceed 3/32 in. for passenger cars and 3/16 in. for commercial vehicles."

Recommended Spring Sizes

Two tables were given in the report, of spring widths and lengths, eye and clip diameters, for passenger cars and commercial vehicles respectively. It was stated in the report that these tables had been carefully reviewed and were in close accord with current practice. In the tables as originally formulated a definite spring width was given for each weight of passenger car and each capacity of commercial vehicle, but the Division in making its report revised these figures so as to give a certain leeway to the designer. The tables in the revised form are reproduced herewith.

All other matters in the report, including spring clips for passenger cars, spring bolts for passenger cars, spring bolts for commercial vehicles, spring pins for commercial vehicles



Passenger Car Springs

Shipping Weight of Car in Lbs.	Location	Approx. Load per Spring (With Passengers), Lbs.	Recommended Spring Length, In.	Spring Width, Inches	Eye Diameter (See Notes)	Spring Clip Diameter, Inches (Alloy Steel)
Under 2500	Front		38	1¾	⅝	¼
	Rear		52	1¾–2	⅝	5/16
2500 to 3000	Front		40	1¾–2	⅝	5/16
	Rear		54	2	⅝	5/16
3000 to 3600	Front		40	2	⅝	⅜
	Rear		56	2 –2¼	⅝	⅜
3600 to 4200	Front		42	2 –2¼	⅝	⅜
	Rear		58	2¼–2½	⅝	7/16

The third sentence of the notes in the data sheet should be omitted and the following note added: "Heat-treated alloy steel spring clips shall be used in all cases.

Commercial Vehicle Springs

Capacity, Tons	Location	Spring Width (Inches)	Min. Length of Spring, Inches	Eye Diam. (See Notes)	Spring Clip Diam. (Alloy Steel) Spring Set on Axle	Spring Clip Diam. (Alloy Steel) Spring Underslung
¾	Front	2 –2½	40	⅝	⅝	⅝
	Rear	2 –2½	50	⅝	⅝	⅝
1	Front	2 –2½	40	⅝	⅝	⅝
	Rear	2½–2½	50	1	⅝	⅝
1½	Front	2½–2½	42	¾	⅝	⅝
	Rear	2½–3	54	1	⅝	1
2	Front	2½–2½	42	¾	⅝	⅝
	Rear	3	54	1¼	⅝	1
3½	Front	2½–3	44	¾	⅝	1
	Rear	3 –4	56	1¼	1	1¼
5	Front	3	44	¾	¾	1
	Rear	4 or 5	56	1¼ or flat end	1	1¼
7	Front	3	46	1	1	1¼
	Rear	5	58	1¼ or flat end	1¼	1¼

The column "Capacity, Tons," is intended only to indicate the general truck capacities on which the corresponding usual spring sizes are used. The above table applies to all types of drives.
Heat-treated alloy steel spring clips shall be used in all cases.

and methods of greasing and oiling spring bolts were not in a form to be acted upon. With the exception of these items the report was accepted by the committee.

Quite an extensive report was made by the Tire and Rim Division, which was read by C. B. Whittelsey. According to this report, it was considered desirable to establish a definite S. A. E. standard list of solid tire sizes toward which all manufacturers could work. It was felt that such a list would also be of material value to the wheel builders as represented by the Automotive Wood Wheel Manufacturers Association. The new list contains the following sizes (together with the equivalent metric sizes): 32x3½, 36x3½, 32x4, 36x4, 36x5, 40x5, 36x6, 40x6, 36x7, 40x7, 36x8, 36x10, 40x10, 40x12 and 40x14.

Solid Tire Cross Section

Some work has also been done on solid tire sections. The first intention was to standardize the sections and contours for solid tires, but as this would tend to limit design the Division recommended that the minimum total cross sectional area of rubber on standard bands for commercial vehicles be as shown in the accompanying table, which is in accord with the schedule worked out and adopted by the Solid Tire Division of the War Service Committee of the Rubber Industry. These areas include the hard and soft rubber used in solid tires.

The recommended minimum cross sectional areas for different widths of solid tires are as follows: 3½ in., 6.75 sq. in.; 4 in., 7.75 sq. in.; 5 in., 10.75 sq. in.; 6 in., 13.75 sq. in.; 7 in., 16.75 sq. in.; 8 in., 19.75 sq. in.; 10 in., 25.75 sq. in.; 12 in., 31.75 sq. in.; 14 in., 37.75 sq. in.

Another recommendation concerned industrial truck tires. Investigation showed that there was little uniformity in the present practice, and after a careful consideration the Division recommended sizes of industrial truck tires and wheels as given in the table on page 311.

Wood Felloe Dimensions—Pneumatic Tire Rims

At a previous meeting the Society adopted dimensions for 6. 7 and 8 in. rims. To complete this specification, dimensions for 3½, 4 and 4½ in. rims were recommended as follows

Industrial Truck Tires

Tire Dimensions		Wheel Dimensions	
Nominal Diameter, In.	Sectional Widths, In.	Wheel Diameter, In.	Widths of Felloes, In.
10	3½	6	2¾
10	5	6	4¼
16	3½	12	2¾
16	5	12	4¼
20	3½	16	2¾
20	5	16	4¼
24	3½	20	2¾
28	3½	24	2¾

"Wheel diameters shall be 4 in. less than the nominal tire diameters. The height of the finished tire is to be 2 in. for all sizes. The width of the wheel felloe is to be in accordance with the present S. A. E. standard truck tire practice and the rim diameter tolerances will be plus 0.005, minus zero." The acceptance of this recommendation will make all the former or present S. A. E. standards for industrial truck tire sizes null and void.

(these felloe band dimensions conforming with those adopted by the Automotive Wood Wheel Manufacturers Association):

Nominal Tire and Rim Size	Width	Depth
30x3½	1½	1½ +1/16 −0
32x3½	1½	1½ +1/16 −0
33x4	1¾	1½ +1/16 −0
34x4½	*2 †2½	1½ +1/16 −0

*Width of felloes for rims with special sections.
†Width of felloes for demountable rims on cold-rolled bands.

Two regular tire sizes for motorcycle wheels were recommended, viz., 26x2¼ and 28x3, and one oversize, 29x3½. Specifications are also given for the dimensions and location of the valve hole in automobile rims.

Nominal Tire Size		Oversize Tire		Tire Seat, Diameter of Rim		Type of Rim
In.	Mm.	In.	Mm.	In.	Mm.	
26x2¼	60/535	None	None	21	535	BB
28x3	75/560	29x3½	90/560	22	560	CC

It has been found that the present specification with regard to edges of felloe bands, which call for a 1/16 in. radius on the outside edges and 3/16 in. on the inside edges of the bands are not acceptable to the steel mills, and the Division therefore recommended that the radius of all edges be changed to 3/32 in.

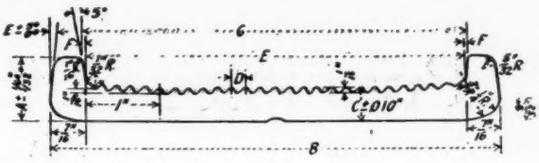
In connection with allowable tolerances for felloe bands the Division recommended that the wording be changed as follows: "Band circumferences after application to wood wheels and circumferences of steel wheels." On account of the difficulty of inspecting circumferences with a tape to the present close tolerances, the Division recommended that the tolerances for "band circumferences before application" be changed to prevailing commercial tolerances of plus 1/32 minus 1/16 in.

Base Bands for Solid Tires

A proposed standard for base bands for solid tires was also submitted. These dimensions conform to the recommended series of solid tire sizes and are in accordance with the base bands recommended and adopted by the War Service Committee of the Rubber Industry. The recommended bands relate to corrugated milled sections and it is optional with tire manufacturers to use either milled corrugated or dovetail facings, as the same general dimensions apply to bands with either facing.

The sections of tires and base bands as recommended for solid tires for trucks are also to apply to industrial truck wheels, and it is recommended that the S. A. E. adopt standard 3½ and 5 in. pressed-on channel sections for industrial truck wheels.

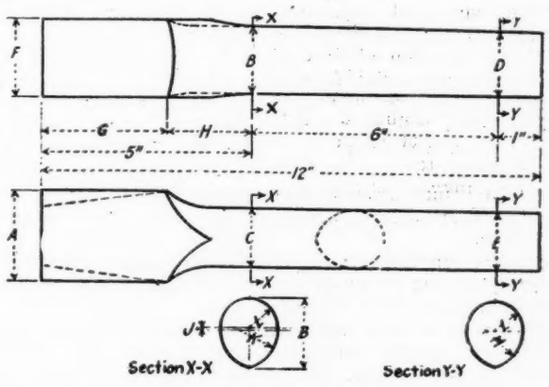
There was some rather animated discussion in connection with parts of this report. Thus, J. E. Hale objected to that



Base Band Size	A	B	Limits of B	C	Corrugations No.	D	E	G	F
3½	¾	4¼	±1/32	1 1/32	18	0.191	3 11/16	3 5/16	1/16
4	2 1/32	4 1 1/16	±1/32	3/8	20	0.196	3 53/64	4 1/16	9/128
5	2 3/32	5 3/8	±1/32	7/16	26	0.189	4 49/64	5 1/16	9/128
6	2 3/32	6 3/8	±1/32	7/16	32	0.185	5 45/64	6 1/16	9/128
7	2 3/32	7 3/8	±1/32	7/16	36	0.192	6 49/64	7 1/16	9/128
8	⅞	8 3/8	±3/64	7/16	40	0.196	7 27/32	8	9/64
10	⅞	10 3/8	±3/64	7/16	50	0.196	9 27/32	10	9/64
12	⅞	12 3/8	±3/64	7/16	60	0.197	11 27/32	12	9/64
14	⅞	14 3/8	±3/64	7/16	70	0.197	13 27/32	14	9/64

part of the recommendation regarding base bands for solid tires which says that it is optional with tire manufacturers to use either mill corrugated or dovetail facings. Mr. Hale said that this would make a dual standard, which would be objectionable. He recommended the adoption of the corrugated facing as standard and said that it was the recommendation of the War Service Committee of the Rubber Industry that this should be the ultimate standard. Mr. Hale received no support on this recommendation, however, and another recommendation made by him, to modify the radii at the corners of the bands, also just failed of adoption when submitted to a rising vote. From another source a recommendation was made that, since there were some objections to the adoption of the base bands recommended, the whole matter should be returned to the Division for further consideration, but this was strenuously objected to by members of the Division and was voted down. A motion to refer the recommendation regarding wood spokes for passenger car wheels back to the Division was also lost, and the whole report of the Tire and Rim Division was adopted.

The last item in the report of the Tire and Rim Division related to wood spokes for passenger car wheels. The dimensions for these spokes are given in the table below.



Wood spokes—passenger car wheels

Nominal Spoke Size	A	B	C	D	E	F	G	H	L	J	K	M
1¼	See	1 13/16	1 1/16	1 13/16	1 1/16	1¼	2¼	2¼	11/16	1/16	1/16	3/16
1½	Note	1½	1½	1 1/16	1½	1½	2¼	2¼	¾	1/16	1/16	3/16
1¾	Below	1¾	1¾	1 1/16	1¾	1¾	3	2	¾	1/16	1/16	3/16
1¾		1 13/16	1 1/16	1¾	1 1/16	2¼	3	2	11/16	1/16	1/16	1 1/16

Notes.—Sizes for A for each nominal size spoke are: 2, 2⅛, 2¼, 2⅜, 2½, 2⅝, 2¾, 2⅞ and 3.

Spoke numbers may be obtained by combining nominal size whole numbers; numerator of nominal size fraction; denominator of nominal size fraction; and number indicating number of eighths of an inch dimension A is over 2 inches. Thus: A 1½-inch spoke when A is equal to 2⅞ inches would be 1127.

All dimensions are for green sizes.

Principles of the Wheeled Farm Tractor*

Factors Determining the Maximum Traction Obtainable — Results of Experiments to Ascertain Rolling Resistance — Operating Efficiency and the Most Suitable Size of Machine

By Edward R. Hewitt
Consulting Engineer, International Motor Co.

THE hydrocarbon engine has in recent years placed us in possession of a light source of power for the purposes of farm traction. It is easily controlled and operated by one man. This has given the farm tractor problem quite a different position from that which it occupied when steam was the only method of propulsion. Although it was possible to make a one-man steam machine, this was not usually done, and the steam plant always had so many disadvantages in starting, use of water, leaking connections, etc., that its extended use was not to be expected.

Given a light source of power occupying comparatively small space, a tractor can take almost any form and yet do some work. While there is certainly vast latitude in design, and many different forms accomplish the purpose equally well, the fundamental principles governing the problem lay down certain postulates which must be followed if we are to reach any reasonable degree of engineering efficiency. It is to the study of these principles that I wish to draw attention, as their neglect has caused tremendous financial losses to both the manufacturers and the public. I will take up the problems, beginning, as we may say, from the ground and giving the results I have reached from my personal observation.

Friction of Wheel Upon Ground

A series of laboratory tests on full-sized wheels, which checked very well with work on the machine in the open, resulted in the following conclusions:

(1) The maximum drawbar pull is a definite function of the weight per inch of width. Weights used varied from 10 to 200 lb. per in.; the ratio of maximum possible drawbar pull to total weight on the wheel was constant for that range. This was found to be true whether the ground was wet or dry.

(2) On sandy ground the drawbar pull available with a smooth metal wheel is about 30 per cent of the weight on the wheel.

(3) On damp, sandy ground the maximum drawbar pull is greater, being about 43 per cent of the weight, and under some conditions even slightly higher.

(4) Cleats increase the maximum drawbar pull only insofar as the soil resists shearing; that is, the cleat carries a section of the top soil and slides it against the soil below the edge of the cleat. Experiments indicated that this was practically independent of the depth of the cleat, depending solely on the shearing strength of the soil at the depth of the cleat edge. In some cases the shallower cleat pulled more than the deeper cleat because the roots in the sod were not cut off and advantage was taken of their shearing strength.

Action of Cleats

In some cases subsoil may be more tenacious than the top, but this is unusual. It might be supposed that when the top is sheared from the subsoil, the soil at the back of the wheel would support it if the section were deep to a greater extent than if it were shallow. This does not appear to be the case because of the lifting action of the back of the wheel which tends to eliminate the support. This is particularly noticeable on hills when the wheel is stressed to the limit. It was found that a cleat inclined forward at an angle would improve this condition somewhat. In going uphill the cleat enters the soil almost horizontally, acting like a step and tending to lift the weight off the wheel. On leaving, the cleat stands almost vertical and causes less friction and loss of power. An inclination of about 30 deg. was found to be the most satisfactory on a 6-ft. wheel. This arrangement tends to self-clean to a great extent. Setting the cleats at an angle of 30 deg. to the axis of the wheel also helps this cleaning effect by a slipping action. The shearing strength of the soils I tested appeared to vary from 5 lb. per in. of width in dry molding sand to 75 lb. in loam or sod. No doubt, tough sod or gumbo may prove even stronger than this.

From these facts it becomes evident that weight is the only means of obtaining a tractive effort of 40 per cent of the weight of the machine under bad conditions in dry ground or sand, as cleats will be of little use. Wheels 72 in. wide would give an added pull due to the use of cleats of only 360 lb. for loose ground. Weight is therefore practically the sole reliance for traction in sand or very dry loose ground. In sod or damp ground 72-in. wheels would ordinarily give 4000 to 5000 lb. pull from the cleats alone, and the light machine with only sufficient weight to hold the cleats down would show good results.

Certain observations in operating a tractor led me to believe that the rolling losses were greater than I had anticipated, and I began a study to determine the laws governing the subject.

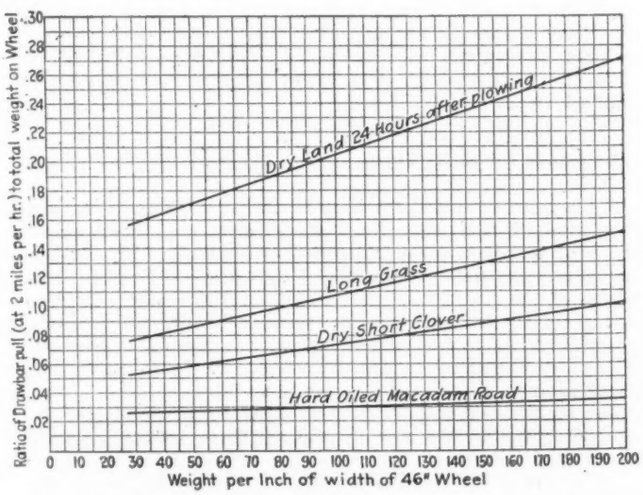


Fig. 1—Relation between weight per inch of wheel width and the ratio of drawbar pull to weight

*Read at the annual meeting of the Society of Automotive Engineers.

I took a watering cart having 46-in. wheels with 8-in. flat tires, and removed the tank, leaving only the stripped chassis. This was towed by a motor truck over several kinds of ground, and the drawbar pull was measured by spring scales. After this I replaced the body and filled it successively with various amounts of water to increase the load per inch of width on the wheels. Four types of ground surface were tested: (a) hard macadam road; (b) dry short clover; (c) sod long grass (gravelly loam); (d) dry plowed land, such as would ordinarily be harrowed, plowed 24 hours previously.

The drawbar pull was found to increase rapidly with the weight per inch of width on a regular curve on all but the hard macadam road, where the increase was only slight. This was to be expected, as the increase in pull is due to the work done in crushing the ground surface, or, in effect, continually pulling the wheel uphill. The limits selected for the tests were those under which a tractor can be built. The curve, Fig. 1, shows the ratio of the drawbar pull required for propulsion to weight plotted against wheel width in inches. The speed used was about 2 miles per hr. I could notice no marked difference in the pull from 1 to 3 miles. On some previous experiments I had observed that the rolling friction of wheels of various sizes varies inversely as their diameter, and I believe that this fact can be used with the chart as a basis for design. It would certainly be valuable to have these observations extended further to furnish a more certain basis for calculation. I have yet to see any precise data on this subject.

The value of these facts is obvious. If a tractor has too great weight per inch of width of wheel and gets on soft ground, as it must do in harrowing, etc., the power consumed in rolling friction becomes a large percentage of the total developed and the drawbar pull is proportionately decreased. There is every advantage in increasing the surface and reducing the weight. Tractors with a weight of over 200 lb. per in. of width of wheels that are even 6 ft. in diameter become very inefficient on soft ground. It is here that the "caterpillar" shows to best advantage, and if it were not for its complication and high maintenance cost, it might prove somewhat better than the wheel for many purposes. When properly proportioned, however, the wheeled machine can be made to give a very high efficiency, as I will show later on, and since wheels can be made to last the life of the machine without expense or renewal, their design is worthy of very careful study.

Weight on Wheels

Considering a four-wheel machine, with the rear wheels as drivers, it is evident that no matter what form of mechanism is used to apply the power to the wheels, the maximum drawbar pull multiplied by its lever arm ($P \times a$) cannot exceed the weight on the front wheels multiplied by a lever arm equal to the distance from the center of the front to the center of the rear wheel ($W \times b$), Fig. 2. The maximum pull which can be applied will be only that required to lift the front weight off the ground. If the machine is on a hill, this weight will be reduced as the cosine of the grade angle. In other words, when we apply power to the rear wheels we are in effect transferring part of the weight of the machine from the front to the rear wheels.

From the preceding curves it is easily seen that the increase in the weight on the rear wheels would increase the weight per inch, and so increase the rolling friction. In the first machine I designed this was very marked, as I increased the weight on the rear wheels 3500 lb. by applying full engine power, and increased the rolling friction from 20 to 25 per cent on plowed ground. The machine, therefore, did not show the drawbar pull it should from power developed by the engine. It took me several months to find the cause of the losses, and I was not absolutely certain until I had actually brake-tested the machine on the rear wheels under full power and found that the mechanical losses from the engine to the ground were only 16 per cent and did not increase materially with the lower gear ratios or increased power. Besides these serious frictional losses, very few machines in this country are proportioned in such a way that the full engine power can be applied on the low gear on any reasonable hill and not raise the front of the tractor off the ground. This interferes with the steering, and in many cases the tractor will turn over if the operator does not shut off the power. This is dangerous, and the full power of the tractor is not available. The utmost care should be exercised in having the weight on the front exactly right for the work it is desired to perform, and any failure here is inexcusable.

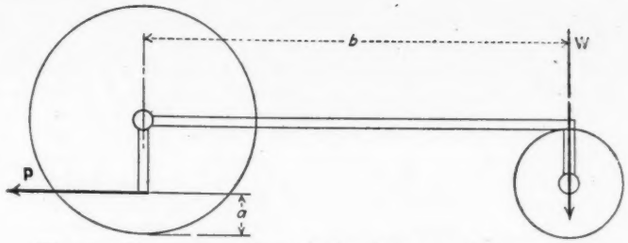


Fig. 2—Diagram of the relation between the maximum drawbar pull developed by a tractor and the weight on the wheels

If we consider a machine driving from the front wheels, the reverse is true, and the application of power decreases the weight on the drivers and reduces the possible drawbar pull which can be delivered with a given weight of tractor. This type is therefore inefficient and will eventually be abandoned. The rear drive type can be proportioned so that nearly all the weight of the front can be carried by the rear wheels when the full engine power is applied, leaving only enough weight for proper steering. This form will then develop the greatest possible pull for a given total weight.

Over-All Efficiency

By using anti-friction bearings, good lubrication and cut gears of good design, it is possible to reduce the frictional losses from the engine to the rim of the rear wheels to less than 16 per cent of the total power developed. I found on brake test of one machine that the losses with a gear reduction of 172:1 on third speed were not materially greater than the losses at 52:1 on the direct drive, where they proved to be 12.5 per cent. This is understood when we consider that we are only interposing two additional pairs of gears, the gears being well oiled and of ample size. As these gears are running in oil when the tractor is operating on the direct drive, they have under these conditions the friction of the oil in the box, which is very considerable, gearbox-oil friction with heavy oil being about 3 hp., and about ½ hp. with light oil. To the mechanical losses must be added the rolling friction on the ground. As seen above, this may vary from 8 to 20 per cent with properly proportioned wheels.

In testing the engine on the brake I used a vacuum gage on the inlet pipe and noted the suction at various loads at the governed speed. When the engine was put on the tractor again I used this gage, which gave me the actual horsepower of the engine within a very small error, as the engine in both cases was operating at the same governed speed. A speedometer was employed that gave the feet of advance per minute of the tractor on each gear. A spring dynamometer was applied to the drawbar, giving the reading in pounds. It was a simple matter to multiply the pounds pull by the feet of advance per minute, get the delivered horsepower and compare it with the actual engine power. It was found that on good sod with short grass the efficiency of the machine was about 75 per cent, i. e., the drawbar horsepower divided by the engine horsepower was 0.75. On plowed ground, harrowing or cross-plowing, it was about 65 per cent, and never fell below that figure. When we consider the low efficiency of touring cars and trucks this seems a very satisfactory result on soft ground, and one which the engineer would scarcely expect to exceed.

The internal-combustion engine of conventional type has one serious drawback: if it is overloaded it stops at once, unless it is operating at a speed such that it is beyond its

maximum torque point, and slowing down allows the torque to increase. In this case the normal load of the engine can be slightly increased at the expense of the speed. These being operating conditions, it is evident that on a tractor the engine must be regularly operated below full load, or a specially hard pull on the plows or a slight hill will cause it to stop or necessitate a change of gears. It is therefore the usual practice to gear tractors in such a way that the engine is operated only at a small percentage of full load, say 40 or 50 per cent. This provides the safety factor for overloads and for defective oiling and cooling, as the overloads may prove to be of short duration. The curves, Fig. 3, taken as an average of tests made during several years in my own laboratory of a number of good engines, show the best fuel economy at various percentages of full load, all tests being made at the constant speed of 1000 r.p.m. The lower curve shows the best fuel economy I have yet obtained when operating conditions were at their best. The curve marked 1 may be taken to represent ordinary practice in commercial tractors. As we cannot operate continuously at full load and best economy, it is interesting to see just how far below this point we can go before the increase in fuel becomes very marked. It will be noted that we should not go below 60 per cent on an ordinary engine, while on the best ones under good conditions a fuel economy of 0.66 lb. per hp.-hr. can be obtained at 50 per cent load. Tractor engines should not be used below this point over long periods. Another point to be noted is the absolute necessity of having the engine oiled and cooled so that it can run all the time at 50 per cent to full load if we are to secure good fuel economy. A tractor, however, should work at certain specified speeds for best results on the tools used, and the pull of these tools will vary as much as 100 per cent in the same field, not to mention hills and variations of rolling resistance.

How, then, are we to get good fuel economy with two changes of gears? In my original machine I had three speeds. The high speed was reversed for road use and could not be used in the field, leaving only two speeds for actual work. I have been obliged to adopt four speeds so as to have three available speeds for field work. These are respectively 1, 2 and 3 miles per hr. at 1000 revolutions of the engine. The latter is governed to 1200 r.p.m. In this way it can be used under the proper load conditions all the time for best economy.

Suction Gage as Load Indicator

I used a suction gage on the inlet pipe as an indicator of the engine load, and have this marked so that the driver knows that it should not read over 8 in. of mercury suction, which is 50 per cent load. This point was selected as the minimum load under which the engine will operate economically. If the suction rises above this point,

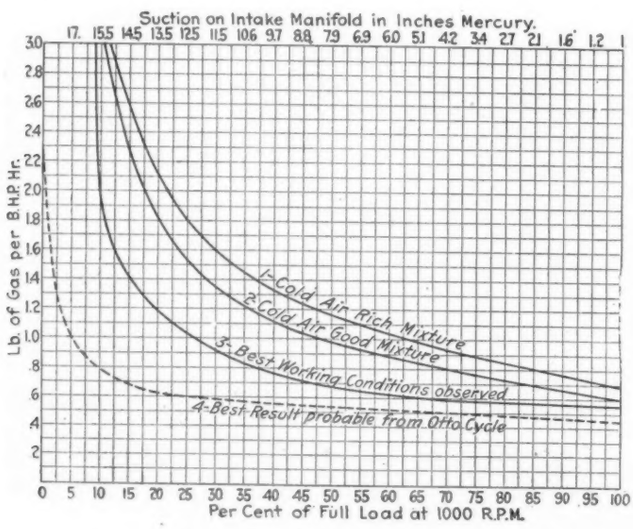

Suction on Intake Manifold in Inches Mercury.
17. 15.5 14.5 13.5 12.5 11.5 10.6 9.7 8.8 7.9 6.9 6.0 5.1 4.2 3.4 2.7 2.1 1.6 1.2 1
Lb. of Gas per B.H.P. Hr.
1- Cold Air Rich Mixture
2- Cold Air Good Mixture
3- Best Working Conditions observed
4- Best Result probable from Otto Cycle
Per Cent of Full Load at 1000 R.P.M.

Fig. 3—Fuel economy at various percentages of load averaged from a number of tests

the driver should shift to a higher gear and load up the engine further. This is just the opposite of touring car practice, where we shift gears because the engine is overloaded and needs relief. On the tractor the heavier the load the better the fuel economy will be and the better the financial result, provided the engine is able to stand this load. We must build engines capable of holding their full power, and a cooling system that will keep them within reasonable ranges of temperature under all conditions, if we are to secure economical operation.

The size of the machine is a subject of supreme importance, and I am in the unfortunate position of being obliged to differ with the general opinion that the small tractor is the future economical unit.

The expense of operating may be divided into the three main headings of operator's wages, fuel and oil, and maintenance charges.

Considerations Affecting Size

The driver on the small machine is paid as much as on the large. The maintenance charges for actual repairs on the larger machine, if properly constructed, are not materially greater than on the small machine. The only difference here will be in the interest and depreciation items. The cost of fuel and oil will prove to be the main difference in expense. This, however, is much lower per acre on the large unit than on the small; therefore, the operating expense per acre on the large machine will be less than on the small machine, primarily because the driver's wages will prove to be at least one-third of the whole cost.

The evident answer to the question of how large the machine should be made is: as large as one man can operate easily and as large as can be run on the roads and pass through gateways and over bridges. I consider that a width of 9 ft. over all on the wheels is the outside limit in practice, and a total operating weight of 14,000 to 16,000 lb. With this weight eight plows can readily be operated, plowing at the rate of 2.8 acres per hr. This would seem to be about the practical limit for a one-man machine. The two-plow machine, on the same basis, would do 0.7 acre per hr. These figures are for the regular progress of the machine over the ground, making no allowance for delays and turns. In factory practice, with automatic machinery, it is found difficult to get more than 80 per cent of the best possible output of the machinery, and this is true when all the oiling and repairing are done outside of working hours and the operators have skilled superintendence.

How much lower ought we to expect the percentage of time in operation to be on a tractor subject to delays for oiling, filling and adjustments, not only of the machine, but of the plows and tools, stopping for corners and turns, shifting gears, etc.? An output of 60 per cent of the theoretical would be very good indeed, and I fear that it often proves to be very much lower. If we take 50 per cent of 7 acres for a day's work we get 3½ acres on an average, and this is more than is usually obtained over any long period with the two-plow machine.

Limit of One-Man Tractor

At the present time there are no eight-bottom tractor plows on the market which can be worked satisfactorily from the tractor by one man. I have made a set for my machine which works fairly well, but it will be some years before these devices can be perfected. Four-bottom plows are now to be had which with a few changes can be made to work fairly well from the tractor. It is probable that at the present time, taking into consideration all the facts of economy, first cost and ease of operation, the four-plow machine is the best suited to build. This is especially true when we consider that it is possible to design a four-plow machine with substantially no side draft and operated with the tractor wheels of ample size running on the unplowed ground.

I have just had the opportunity of getting figures from three of the best standard makes of machines working in Orange County, New York, on difficult land. They were operated for a whole season by a township committee. The

machines have averaged about an acre a day each during the season. The same money invested in horses would have done more and a larger variety of work. The cost per acre has been much greater than with horses, and the three machines all need rebuilding at considerable expense. With a capacity of 20 to 30 acres a day, we have a good chance to get 10 or 15 acres regularly. In my view, it is not the first cost of the whole outfit that will be the deciding factor, but the investment per acre worked per year. If the large and more expensive machine will do the work more cheaply, and at the same time show a lower investment per acre, it will be the one to survive in the long run. Small machines are advertised to pull mowing machines, reapers, cultivators, etc. It seems rather a step backward to be pulling these machines by a means costing at the lowest estimate from $5 to $8 a day to operate, when we can do it with horses at not over $4 to $4.50; or to be running a thresher and silo cutter with a machine costing between $900 and $1,500, when we can do the same work with a stationary engine costing between $200 and $300; while the tractor could be plowing and doing expensive work on the farm. My view is that the small tractor is rarely needed at all for the small farm. On any farm up to 100 acres the work can be done with horses more cheaply and better, especially if the farmer uses the right crop rotation and carries enough live stock. The small tractor would only be a source of expense, as he would certainly have to keep horses as well. The tractor should have at least 200 acres to cover a year, and better still, 500 or 1000. On this large output a skilled man can be employed and the machine properly worked. The tractor and farm tools that the farmer will have available for some years to come are certain to be the kind of machinery that should not be placed in the hands of the untrained.

In closing I would like to add a word as to what can be expected in the future as to the maintenance and durability of good tractors.

A motor-truck designing experience of twelve years has taught me that a well-made, properly designed gearbox and clutch will last from five to ten years with no repairs, and I see no reason why we should not expect even better results on tractors if we proportion the loads properly, especially as the tractor will not operate more than 120 days a year. The wheels on my machine show no wear after two years' work, and I am sure they will last the life of the machine, with the possible renewal of cleats every four or five years. The frame, riveting and steering-gear can be made absolutely durable. The two places in which we will have excessive wear are on the final drive to the rear wheels and on the engine. The main drive to the wheels is not durable on any machines I have seen. On my own it has lasted two years and requires renewal. It will be replaced with a drive of better proportion and materials, and better protection from dirt; I hope to get four years out of it at least. This can no doubt be further improved. On the engine the main source of wear is the dust in the cylinders. Even with a fine muslin dust filter 8 sq. ft. in area the pistons and rings were badly worn in 100 days' running. A perfect air cleaner is an absolute necessity for tractors. Those I have seen advertised thus far are all of types which will not really remove the finest particles of dust, which do the actual damage to the engine, and they cannot eliminate the trouble. If we succeed in protecting the engine from dirt, there is no reason why we cannot get ten years' service out of it with a regular overhaul every year or two. I know of motor-truck engines in operation to-day which have been in constant use for over ten years, and I firmly believe we shall make a tractor in the near future with a very low maintenance cost and a very low operating cost per acre. I believe we may hope to plow for about 60 cents per acre, on good land, this including all charges, as against $3 to $4.50 with horses. If this is accomplished, the tractor engineer will have done his bit toward solving the food problem.

Sidelights on Oil Refinery Practice*

A Discussion of Four Possible Methods of Increasing the Supply of Fuels Available for Use in Present Types of Automotive Engines

By E. W. Dean
Bureau of Mines

THE several most important ways in which the petroleum refining industry can increase the output of gasoline from a given quantity of crude oil may be listed as follows:†

(1) Universal adoption of a high "endpoint" or upper volatility limit for gasoline
(2) General use of more efficient distillation methods and equipment
(3) Recovery of gasoline now lost in refinery operations
(4) Wider use of cracking processes

There are considerable differences in the grades of gasoline marketed throughout the country by different refineries and sometimes at different times by the same refinery. A notable point of variation is the upper volatility limit, or "endpoint." In the days when gasoline was simply a by-product of the refining industry, the endpoint figure was approximately 150 deg. Cent. (302 deg. Fahr.). This type of gasoline is now practically extinct, and the so-called "high-test" engine fuel now marketed in relatively small quantities has an endpoint of approximately 175 deg. Cent. (347 deg. Fahr.). The usual grades of gasoline are represented by endpoint figures between the limits of 200 deg. Cent. (392 deg. Fahr.) and 230 deg. Cent. (446 deg. Fahr.).

The fact that gasoline of as high endpoint as 230 deg. Cent. (446 deg. Fahr.) is being used in tremendous quantity and with satisfactory results renders it desirable to consider the possible increase in engine fuel supply if this upper volatility limit were universally maintained.‡ The Bureau cannot at present go on record as either advocating or op-

*Read at the annual meeting of the Society of Automotive Engineers. Published by permission of the Director of the Bureau of Mines.

†One other possibility might be mentioned: the refining of crude petroleum now marketed as fuel oil without removing its naphtha content. The Bureau has not, however, succeeded in uncovering statistical evidence indicating that developments in this line could augment production by a maximum of more than 3 to 5 per cent of the quantity of gasoline now refined.

‡In this connection it is interesting to note the probable increase that would result if the endpoint universally adopted were sufficiently high to include the fractions of petroleum now marketed as kerosene. Bureau of Mines refinery statistics for the calendar year 1917 show that about 20 per cent of the crude petroleum refined was marketed as gasoline, and about 11 per cent as kerosene. If, therefore, the endpoint selected were high enough to include both of these fractions, instead of stopping with a figure representative of the "heavy" engine gasolines of to-day, the resulting increase in supply would be 55 per cent, instead of 15 to 20 per cent. Wherefore, it appears that even the long-sought kerosene consuming engine is not going to keep the automotive industry on "easy street" for many years.

posing such a standard, but is simply discussing what might be accomplished in the way of increased gasoline production if it were adopted. The present estimate, based on miscellaneous data at hand, is that from 15 to 20 per cent more gasoline would be available if a universal endpoint equivalent to that of the "heaviest" grade at present marketed in quantity should be maintained.

The possibility of such a standard is, incidentally, dependent upon either a considerably increased production of casinghead gasoline or the development of engines that can utilize liquid fuel having smaller properties of volatile constituents than the types now marketed. The high endpoint gasoline now marketed is almost invariably of the blended casinghead type.

The distillation methods employed by petroleum refineries do not operate with the same degree of efficiency that is attained in some other industries. Certain percentages of hydrocarbons boiling below the accepted upper temperature limit for gasoline are always present in kerosene or fuel oil. This does not necessarily discredit the technical ability of refiners, many of whom are maintaining as high a degree of distillation efficiency as is profitable under present commercial conditions. There is no doubt, however, as to the possibility of augmenting the gasoline supply through an increase in the average distillation efficiency of refineries, and it is important to estimate the order of magnitude of the probable gain.

Here again exact data are lacking, and reliance has been placed on miscellaneous indirect evidence. The probability seems to be that efficiency in gasoline recovery varies in different refineries between the limits of 75 and 95 per cent. The latter figure is probably about the maximum that can be economically attained, and the average is undoubtedly not lower than half way between the limits. It is, therefore, improbable that the nation's supply of gasoline will be increased more than about 10 per cent through advances in the technique of large scale petroleum distillation.

Recovery of Gasoline Lost at Present

Bureau of Mines refinery statistics for 1917 and for the first seven months of 1918§ show that an average of about 4 per cent of the crude oil treated was lost in the course of refinery operations. Part of this loss was, of course, inevitable, but part represented gasoline that escaped with refinery gases. Recovery of this gasoline could have been effected by the use of methods and equipment similar to those employed for the production of casinghead gasoline. Such processes are already successfully operating, and there is no reason to doubt that the extraction of gasoline from refinery gases will eventually become a general practice.

Assuming that half of refinery losses are preventable in this way, it appears that gasoline amounting to about 2 per cent of the crude oil refined and about 10 per cent of the gasoline produced could be added to the supply of motor fuel.

The wider use of cracking processes is without doubt the most promising means by which refiners can increase their output of gasoline from a given amount of crude petroleum.

In a paper presented before this Society about a year ago,‖ the author ventured to state an opinion to the effect that, if cracking processes were employed to the full extent of their applicability, the total production of gasoline from the quantity of crude oil now produced might be doubled. This statement is one that indicates considerable optimism for the future of the cracking art, and the Bureau has been agreeably surprised at its failure to arouse controversy. To prevent any future misinterpretation, it is perhaps best to make clear the fact that this statement implies a possibility, the commercial feasibility of which is yet to be demonstrated.

The future of cracking processes may be affected by the development of unfavorable conditions of various sorts. Two in particular deserve mention in the present connection.

Up to date, the development of the art of cracking has been far from complete, in spite of the considerable attention that has been given to this line of technical operation. Only one process, that of Burton, is to-day a real commercial factor in the production of motor fuel, and this is representative of a type that seems to involve certain inherent limitations in applicability. If the cracking reaction is to be applied to the extent necessary for a doubled gasoline production, other types of processes must be put into successful commercial operation, or the present apparent limitations of the class in which the Burton process belongs must be obviated. The Bureau of Mines is optimistic regarding the future commercial success of several other processes, but believes it is only fair to state that such success is not known to have been attained, as yet, in any large measure.

A second development that may restrict cracking operations is the existence of an unfavorable ratio between the market prices of gasoline and fuel oil. The production of cracked gasoline necessitates the consumption of fuel oil, and, if the demand for the latter commodity exceeds the supply, its price is bound to rise and the margin of profit of cracking processes wiped out. It is an open question as to whether or not the consumption of fuel oil can ever be reduced sufficiently to permit doubling the production of gasoline by the use of cracking processes. The Bureau of Mines cannot venture any prediction in this line, except that the price of gasoline is likely to exceed the present level before cracking processes will be employed to the extent indicated.

Summary

The estimates included in the present series apparently indicate that the refiner may be able to augment his production of gasoline from a given amount of crude petroleum by from 35 to 40 per cent, exclusive of the gains possible through wider application of the cracking reaction. Some of the possibilities, however, overlap each other, and a more probable summation estimate is 25 to 30 per cent. The Bureau believes that, if commercial developments are favorable, the wider use of cracking processes may permit of further increases up to a possible additional 100 per cent. No prediction, however, is ventured as to what part of this figure will actually be attained.

It may be mentioned, also, that the development of engines capable of utilizing the combined gasoline and kerosene fractions of crude petroleum would not be likely to alter the limit of maximum increase, but would materially hasten the day when it would be attained, and would, in considerable degree, help to keep the price of liquid fuel from ascending to painfully high altitudes.

The present paper may have produced the impression that the Bureau of Mines is not enthusiastic over the advantages to be gained by the development of a kerosene-consuming internal-combustion engine. Such is not the case, but it must be emphasized that this is not the only line along which the automotive industry must work.

In preparing the present paper, the author has made extensive use of statistical information collected by H. F. Mason of the Bureau of Mines. The evidence upon which estimates are based has been reviewed with H. H. Hill, J. P. Smootz and E. E. Lyder of the chemical staff of the Bureau of Mines, Petroleum Division, and the figures given have been agreed upon as most probable.

§Senate Document No. 280, Sixty-fifth Congress, second session. Letter from the Director of the Bureau of Mines, entitled "Production of Crude Oil," Sept. 24, 1918.

‖E. W. Dean, "Fuel for Automotive Apparatus," *Journal of the Society of Automotive Engineers*, vol. 2, No. 1 (January, 1918), pages 47 to 53.

A RATHER dismal picture of the immediate outlook for the French automobile industry is painted by Charles Faroux in *La Vie Automobile*, which after more than four years' suspension has just resumed publication. Mr. Faroux says that the automobile factories have no stock under way, it is very difficult for them to obtain their raw materials, the labor situation presents problems of a most disquieting nature, and a terrible competition has to be faced not only from foreign countries but in France itself. By the latter statement Mr. Faroux makes reference to the tens of thousands of passenger cars which have been in use by the army and which are to be disposed of at public auction. He makes the suggestion that these army vehicles should be overhauled by their manufacturers and that the difference between the price realized on them at public auction and the sum demanded by the war department should be divided between the State and maker.

SIDE GUIDE AND GRIPPER

Possible Effect of Aircraft Experience on Automobile Practice

Three Leading Engineers Give Their Views

Howard Marmon says: *Order of importance of desirable features is entirely different in automobile and aircraft engines and main effect of aircraft experience will be improvement of shop practice.*

O. E. Hunt says: *Aircraft experience has increased respect for good metallurgical practice, giving the manufacturers a new conception of the value of high grade workmanship and of the small margin of cost over the ordinary.*

Henry M. Crane says: *There will be a continual beneficial interchange of information between the two lines of engineering, but their practices will diverge rather than approach.*

Plane and Automobile Engines Compared*

By Howard C. Marmon

IN physical construction the four-stroke cycle airplane and the automobile engine are identical. From the delivery of the fuel to the carbureter to the delivery of the power generated at the crankshaft end, the processes are the same. An automobile engine could be made to fly an airplane, and an airplane engine or a replica of it on a reduced scale to bring the power within usable limit could be made to operate an automobile. A long series of disappointments has emphasized to all of us the fact that any aggregation of parts assembled to obtain a mechanical result is a series of compromises, and the relative importance of the objectives governs the nature of the compromise.

Controlling Factors in Design

The major objectives that govern the compromises to be made in the design of airplane or automobile engines are roughly as follows in approximate relative importance. We are considering the airplane engines that have been developed for use in warfare. They must have

(1) Reliability
(2) Small weight per horsepower
(3) Economy in fuel and oil consumption
(4) Carburetion that permits easy starting and maximum power through a range of 30 per cent of the speed range, and idling at one-quarter maximum speed without danger of stalling. In short—no great degree of flexibility is required.
(5) Ability to deliver full power through a small speed range without excessive vibration.
(6) Complete local cylinder cooling under conditions of high mean effective pressure.
(7) Compactness.

In general, it can be assumed that the airplane engine will receive expert attention daily; it will be operated on a homogeneous highly volatile fuel and be lubricated with good oils. Relatively little regard need be given to the expense involved in fabricating any part of the engine or in the original tooling-up. Further, a comparatively small part of its life will be spent at sea level and none in a dust-laden atmosphere.

The automobile engine must have

(1) Reliability
(2) Silence
(3) Carburetion that accomplishes proper and even firing in all cylinders under varying throttle conditions, through speeds covering more than 90 per cent of the speed range of the engine. In short—great flexibility. Economy is secondary to this requirement.
(4) Ability to deliver partial or full torque through its entire range of speed without vibration.
(5) Compactness
(6) Small weight per horsepower.

Difference in Service Conditions

In general, it can be assumed that the automobile engine will receive attention at infrequent intervals and then usually at the hands of an inexpert person. It will be operated on

*Read at the annual meeting of the Society of Automotive Engineers.

SIDE GUIDE AND GRIPPER

fuels of low volatility and lacking in uniformity, and varying grades of lubricating oils will be used. The cost of fabricating the parts and tooling-up must be kept in mind. Further, the engine must be designed to operate at higher speeds than is customary in airplane engines. Its entire operation is likely to be near sea level and often in a dust-laden atmosphere.

Reliability has been given as a prime requisite for both types of engine. It should be remembered that an automobile which has traveled 10,000 miles has had its engine running from 300 to 500 hr. This is considerably in excess of the normal life of an airplane engine in warfare. A typical two-seated airplane loaded with all its paraphernalia for reconnaissance work and the incidental fighting would, as it left the ground, have 20 per cent of its weight represented by bare engine and 15 per cent by fuel for a 3 or 4 hr. flight. These figures represent the extreme that has been attained in lowering the power-weight ratio and in fuel economy. A typical automobile carrying five pasengers and fuel for an 8 or 10 hr. run would have, not including flywheel, clutch and starter, less than 10 per cent of its weight in engine and 3 per cent in fuel.

In obtaining the greatest power output per pound of weight, it is necessary to get the greatest power output per cubic inch of piston displacement. In the airplane engine the most successful solution has resulted from the use of a compact combustion chamber, valves of ample size, large passages in the intake manifolds, carbureters designed especially for the engine speeds contemplated, and the highest practical compression pressures, bearing in mind that a fuel of high volatility is to be used and much of the operation is to be at reduced barometric pressures.

High Compression Cannot Be Used

The automobile engine will not equal the airplane engine in power per cubic inch piston displacement, as it must be carbureted for greater flexibility and not solely for maximum torque output through a comparatively limited range of speed. Two to four carbureters, as is usual on multi-cylinder airplane engines and which add to their maximum output, would not be welcomed on the automobile.

Nor can the automobile engine use a compression pressure as high as that of the airplane engine, which means that its power for a given displacement, output and fuel economy must be lower. The high compression pressures would be impracticable at the full load and low engine speeds required of the automobile engine, but not of the airplane engine.

The lower grade fuels commonly used in automobile engines are more troublesome under high compressions than the fuels customarily used in airplanes. It should also be remembered that the higher the compression ratio it is possible to use at ground level in an airplane the better the engine functions at altitude. At an elevation of about 15,000 ft. the compression pressure is reduced about 40 per cent.

Compact combustion chambers make valves in the head necessary. Mechanically the most efficient way yet devised to actuate these valves is the overhead camshaft and the use of abrupt cams. The gear train for operating the overhead camshaft from the crankshaft is rather complex and expensive, but by using proper materials can be made very light and durable.

Reduced Weight in Cylinder Construction

The greatest weight reduction in cylinder construction seems to be obtained in the steel cylinders with welded-on jackets, usually individual. All-steel cylinders are available only for valve-in-the-head engines. Steel cylinders have a particular advantage in that it is possible to get cooling water close to the interior walls of the combustion chamber and to the valve seats. This is of considerable help in connection with high mean effective pressures and tends to reduce carbonization. Steel cylinder walls can be made so thin that they will permit the bore of the cylinder to increase 0.010 to 0.012 in. during the explosion stroke without affecting the power output.

If the steel cylinder is the lightest and lends itself readily to the most effective way of producing power for a given displacement, why should it not be adopted for automobile use? For passenger car use its comparative excessive cost is the least of the objections. *Per se*, the steel cylinder wall offers no advantages over cast iron. In European aviation practice, notably in air-cooled engines, steel cylinders have been lined with cast-iron sleeves about 1/32 in. thick. In its best development, for ease of manufacture, least amount of water weight, and the best circulating water distribution, the steel cylinder is of the individual type. Individual cylinders in a passenger automobile are not desirable because of the increased over-all length consequent upon such a design, the multiplicity of water, gas and exhaust connections and valves in the head. With steel cylinders valves in the head may be operated by push-rods from a camshaft in the crankcase, as in the Benz aviation engine, but for automobiles the problems of enclosure against dust and proper lubrication of parts present difficulties that are not easily solved.

Faults of Overhead Camshaft

An attempt to operate the valves of a passenger automobile with the overhead camshaft would not be likely to succeed commercially. Not only would its comparative complexity over other methods of valve operation producing excellent results be against it, but, what is more important, no durable way of driving an overhead camshaft and all the accessories required on an automobile has yet been devised. It seems to be fundamental that a passenger car engine must operate with a total amount of noise that is, at the most, unobtrusive.

In addition to this, the cylinder walls would have to be thickened to a point where no spring from the explosion pressures would result in that constant source of trouble to the manufacturer, piston slaps. Some of the weight advantages would diminish with this change.

One of the greatest contributions to our knowledge of engine manufacture resulting from airplane engine production is the steel cylinder, and, strangely enough, probably the greatest application of steel cylinders will be on the large truck or the tractor engine. Here the noise is less important, as is also the fore-and-aft bulk. The unusual cooling advantages offered by the steel cylinder fit it particularly for heavy duty under the unfavorable conditions often required of the truck or tractor. The small relative mass of such cylinders is conducive to their staying in place without the loosening or fracture due to the excessive vibrations often encountered in such cases from causes other than engine operation.

Design of Crankshafts and Crankcases

In the design of an airplane engine crankshaft, the need of minimum weight per horsepower will govern. A material of high specific strength will be used, and empirical data will be employed in the design to avoid periodic vibrations in the narrow speed zones in which the engine operates. In the layout of the automobile crankshaft, it must be remembered that all periodic vibrations must be avoided from the lowest speed to speeds higher than those employed in the airplane engine. This results in designing for a certain stiffness, which would enable the use of material relatively inferior but still having sufficient strength. Hence the requirement of smooth operation under a greater variety of conditions makes it imposible to meet, in the automobile engine, the low weight factors of the airplane engine.

What may be termed the "tubular" type of crankcase is the lightest on a power-weight basis and presents the greatest opportunity for heat dispersion from bearings of any crankcase design yet offered, and is widely used in airplane engines. It is split on its horizontal axis, the upper portion carries one-half the crankshaft bearings and the lower portion the other half, and the two halves are bolted together with bolts going entirely through the case. The conventional automobile design in which the upper half of the crankcase, plus whatever bridgework reinforcement the cylinders offer, carries the entire crankshaft load; the lower half, being merely an oil container, is quite appreciably heavier. It will, however, in all probability be retained for automobile work on account of its greater accessibility and the greater ease with which corrections for wear can be made.

Total bearing loads and the effect of parts that apply these bearing loads will be greater in automobile than in airplane engines, as higher engine speeds must be provided for. The forces due to reciprocation of parts become greater in proportion to the horsepower output than in the airplane engine. The factor V^2 of the MV^2 equation increases more rapidly than the factor M can be reduced.

Higher mechanical efficiencies with their correspondingly greater horsepower output per cubic inch will be obtained from the airplane engine than from the automobile engine. The easy clearances on the pistons, the ample freedom given all the bearings, the gear trains, etc., that mark the assembly of the airplane engine produce a machine that responds and is ready for the hardest duty at the moment it is first "fired." Give the automobile engine this same mechanical freedom, and one of the prime requirements of automobile engines—silence—will be so lacking that the engine would be promptly condemned.

The need for economy of fuel and oil has been emphasized. It appears that any fairly conventional water-cooled engine, with a reasonably compact combustion chamber with cylinders sufficiently well cooled locally to permit good compression pressures, can reach ½ lb. of fuel per b.hp.-hr. over the speed and power ranges required. Over equivalent ranges, with proper allowances made for reduced compression ratios, automobile engines will compare very favorably. However, the requirements of great flexibility, sudden demands for idling, quick acceleration in crowded traffic conditions, present economy problems for which airplane engine history provides no parallel.

While the steel-cylindered airplane engine has been considered principally, it is not intended that the well-known aluminum jacket engines, and the Bugatti extraordinarily clever design using all cast iron above the crankcase, which engines produce much the same results when installed in an airplane, be overlooked. They have one advantage for automobile use not possessed by the steel-cylinder engine—more complete inclosure of valve operating parts. However, an analysis of all of them will show that the objectives aimed at have necessitated compromises as do other constructions.

An Airplane Engine in an Automobile

Let us now see what happens if we take any four-, six-, eight-, or twelve-cylinder aviation engine and make a faithful replica of it on a reduced scale so that its power output fits the needs of the particular car we wish to try it in. The engine will be heavier per horsepower than its prototype; cylinder walls will be as thick; crankcase walls will be as thick, as undoubtedly foundry practice dictated the thickness of the larger one; ignition, spark plugs, float chamber and many similar parts will weigh as much per cylinder as in the larger engine. The weights in pounds per horsepower will show a considerable increase. However, when installed in the car, and the usual flywheel, clutch, starting and lighting systems, tire pump and so on are added, it will weigh from one-half to two-thirds as much as engines employed in usual practice.

A trial of the car so equipped will show some extraordinary performances in speed and hill climbing when the original start for the hill is rapid. City driving under traffic conditions or heavy pulling at low speeds will demand a new carbureter and intake system to meet these conditions. This will seriously affect the conditions that made the first impressive performance. When satisfactory control of the engine has been established, noises demand attention. A general snugging up of parts helps, but a few noises remain that it is finally decided can be corrected only by a redesign, probably of the valve operating gear. All this affects the original performance adversely. After this has been done, certain conditions of operation will require an enlargement and stiffening of the crankshaft to eliminate an annoying periodic vibration. The result is an engine not a great deal lighter or more efficient than the one originally designed for the car.

Airplane Engine a Higher Type

The airplane engine is a more expertly engineered and better manufactured development of the internal-combustion engine than the automobile engine. It is, however, developed for a set of objectives different than those demanded in an automobile, and none of its major features can be directly grafted upon the motor car. It is true that a multitude of engineering minutiæ have been developed that are applicable to the motor car, but the total result in operating performance is small.

The greatest contribution from the airplane engine to the motor car industry has come through the builder of the engines. He has shown that, given a definite set of specifications and a definite request for results, engines will leave his factory with absolute assurance as to what they can do. Some of the optimists have suspected this, but the war's aviation engine experience has proved it.

Motor cars will be improved as a result of our airplane experience, but this improvement will be apparent in the service the car gives, rather than in any radical changes in design. This will come about as a result of better manufacturing facilities, higher shop standards and more intelligent inspection.

Will Give Us Methods of Producing Light Weight Results at Moderate Expense

By O. E. Hunt
Chief Engineer, Carriage Division, Packard Motor Car Co.

IN the introductory part of his paper Mr. Hunt points out that although there is a corresponding part in an airplane for almost every part of the motor car there are such differences in the requirements made of the control system, body and transmission in the two types of machines that little learned in connection with airplanes will be applicable to automobiles. He then proceeds to discuss the subject of engines, which, of course, is a different matter.—EDITOR.

EXPERIENCE gained in reducing the weight and increasing the volumetric efficiency may help in a limited way to reduce the weight-horsepower ratio of car engines, but not nearly to the extent some engineers would have you believe, because, in spite of similarities in design, the engine requirements for airplane service are so far different from those for cars that factors that are vital in the former type of machine are of minor importance in the latter and vice versa. In an airplane engine dependability, light weight, high mean effective pressure, excellent economy, first cost, flexibility and quietness are controlling factors in about the order listed, while in the case of the car engine the relative order of importance is almost completely reversed and would read dependability, flexibility, quietness, first cost, economy, light weight and high mean effective pressure. Some may take exception to the order given for cars, particularly as regards first cost and light weight, but if you stop to think that probably over 90 per cent of our total car producion is designed to fit a definite price class you will realize that cost has a predominant place in the design councils of the industry as a whole, and that light weight is of major importance only as it results in the reduction of the total amount of material to be purchased, thus reducing the material bill. Flexibility and reasonable quietness, like dependability, have come to be expected in all cars, and no car that does not give a proper

performance in these respects can hope to endure in public favor. I must confess that in placing economy below first cost I am reflecting the buyer's attitude, as he, thanks to the manufacturer's reputation for never understanding his case, will give greater weight to a known economy of first cost than a promised economy of operation.

Airplane engine design detail that will increase dependability is immediately useful in cars provided it does not entail an abnormal increase in first cost. Airplane spark plug development is an example. There are other minor ones that I shall not attempt to list in detail here.

Little Regard to Cost

In general, light weight in airplane engines is obtained by the unusual use of light materials such as aluminum, regardless of cost, and by the reducing of all parts to the smallest section that will give a satisfactory dependability with little regard to the labor involved in so doing. Aluminum has been generally used for oil-pumps, water-pumps, cylinders, and to a greater extent in carbureters, induction pipes and electrical equipment than is common in car engines. A most significant sample of the minimum section method of obtaining lightness is the all-steel cylinder used on the Liberty and some other airplane engines. I believe that the more extensive use of aluminum in car engines is going to be stimulated by this experience provided the price of this alloy comes down to a point where, better machining quality allowed for, it can compare fairly well, in cost of the finished piece, with cast iron. There does not seem to be much cause to expect a landslide to light parts of the steel cylinder variety, as the cost of producing them by present methods is out of all proportion to the dividends they would pay in car service. Commercialization of the airplane engine will undoubtedly be along the lines of perfecting less expensive methods of manufacture for such parts. This may ultimately result in costs low enough to warrant their use in cars.

High Volumetric Efficiency

Many improvements contribute to high volumetric efficiency in airplane engines. Overhead valves are already used to a limited extent on car engines, but the overhead camshaft that is almost universal on airplane engines is practically unknown on cars outside the racing class, because of the difficulty of getting a quiet and inexpensive form of drive. Very high compression and open exhaust are barred for car use because the former militates against flexibility and the latter is too noisy. Abnormally large valves and high lift are generally frowned upon in cars because of the tendency to a lesser valve life and quietness in combination. The unusual care taken to cool valves and spark plugs in airplane engines to combine proper dependability and high efficiency usually involve structural features of the steel cylinder type that are too expensive for cars. Abnormally large intake passages and carbureters are not usable in automobile engines because of their unsatisfactory effect on flexibility. On the whole, one must proceed very cautiously with the use in cars of design "stunts" that contribute to raising the mean effective pressure in airplane engines or he may find to his sorrow that he has sacrificed results that the public insist upon as necessary to satisfactory car performance. There seems to be no immediate promise of a general increase in the average mean effective pressure of car engines based on airplane experience.

Fuel Economy

The dead load that present-day airplanes can handle satisfactorily is relatively small. The power required to give them satisfactory performance is so high that a considerable proportion of this dead load must go to supplies, leaving only a small portion for useful load or if a large useful load is desired the flight range is small. Economy of fuel is then of real importance. Good distribution, a carbureter setting as lean as will give full power over the engine speed range ordinarily used in flight, but not so lean as to accelerate valve burning, and a sensitive means of reducing the fuel flow to an amount that will give a proper mixture with the lighter air at altitude, are the design details used to accomplish it.

The distribution and mixture adjustment experience is usable on cars, but it is obvious that the high-speed lean setting would not give a proper flexibility. Oil economy is of much less importance from the weight standpoint, but it is carefully watched in airplane engines and the methods of producing a proper result in them will be useful in car design. Accommodating the oil supply to the load, which is very essential in airplane engines, has produced schemes for the interconnection of the throttle with the oil-pressure regulator that may find their way into cars of the higher grades.

Cost—Flexibility

It is a well-known fact that first cost has been largely forgotten in war airplane engine design where there was any military advantage to be gained by so doing. Such an atmosphere obviously has not tended to produce design detail that could be used in cars, where first cost is of great importance. Flexibility, or more particularly speed range at full load, is relatively unimportant in an airplane engine which operates in the upper 20 per cent of the possible range with a given propeller for at least 90 per cent of the time it is at work. Flexibility being sacrificed to economy through the remainder of the range, it is obvious that we can learn nothing in connection with this car essential from airplanes.

In airplane service the noise of the propeller and the open exhaust drown out the mechanical noises of even the least quiet engines. Until they are eliminated, and there seems to be no prospect of getting rid of the propeller noise, airplane engines can continue to rattle and "slop" in a way that would drive the average car user to distraction.

Summary

A summing up of all this evidence indicates that there is very little ground for a feeling that airplane experience will suddenly and immediately revolutionize cars. We may, market conditions being right, see an increase in the use of aluminum. If aircraft are commercialized to an extent that demands a volume production of engines, we may develop methods of making the minimum section type of lightness that will make this practice usable in cars. There may be an increased tendency to overhead valves and overhead camshafts if the mechanism involved can be made sufficiently inexpensive and quiet. There are possibilities of minor improvements in carburetion and oil control and in some other details.

I believe, however, that the most important contribution that the airplane has made to the automobile is the stimulus to the thought of the industry as a whole that has resulted from a contact with its design and manufacturing problems. Our war experience has set engineers to dreaming of ways to produce a light weight result at a moderate expense. It has taught an increased respect for good metallurgical practice as a necessary factor in successful design and manufacture. It has given the average manufacturer who engaged in airplane engine building a new conception of the value of high-grade workmanship and of the small margin of cost that, in many cases, separates it from the ordinary variety. I should say that in setting up new ideals of design and workmanship for the industry to strive toward it has given us an inspiration of far greater value than any design details could possibly yield.

[*The third paper of this series begins on the following page*]

New High Altitude Uniforms Worn by Airplane Pilots

Valve-in-Head and Aluminum Cylinder Engines Will Increase

By Henry M. Crane
Vice-President and Chief Engineer, Wright-Martin Aircraft Corporation

DURING the four and one-half years of the great war, an enormous amount of development work has been done on various types of engines suitable for use in aircraft. It is only natural, now that peace has come, to speculate as to what effect the knowledge thus gained will have on the design of motor cars.

V-type engines are those comprising two rows of cylinders. There have been a number built, also, with more than two rows of cylinders, but none of them has come into any considerable use, and in any case it is difficult to see how they would have any bearing on motor car practice. There have also been several engines having eight cylinders in a row, such as the Mercedes and Bugatti, but these do not seem to be interesting to the motor car engineers.

If we look at aviation engine design, as represented above, from a general point of view, there are several interesting features of considerable prominence that are practically standard at the present time. These features are the four-stroke cycle, the use of valves in the cylinder-heads and the use of more or less complete force-feed oiling. I do not want to be understood as saying that engines not embodying these features have no great possibilities. I have limited myself in this case to the engines that have actually proved themselves in service.

I think it is fairly obvious why the apparent standardization has taken place on the lines described. There is no question that the four-stroke cycle poppet valve engine, with valves in the head, is the lightest for its horsepower that has yet been developed into commercial use. The valve-in-the-head type, using poppet valves, has the simplicity, compactness and light weight of individual parts, which make up a light total weight. The four-stroke cycle, due to positive charging and efficient scavenging, allows very high speeds, and therefore high powers for a given size cylinder as well as excellent fuel economy. The constantly increasing speed of airplanes and the development of geared engines have made it possible to take full advantage of these characteristics.

Force-Feed Oiling Increases

The use of force-feed oiling has naturally come to the front, in view of its positive action, and because the oil circulation is of great assistance in cooling parts of the engine that would not otherwise be properly cooled.

Of course, we know that the important feature in an airplane engine is reliability of operation, together with the lightest possible weight for a given power, the weight necessarily being taken as that of the whole power plant, including all cooling accessories, fuel, oil and the necessary tanks for the length of flight required. On the other hand, long life, durability and ease of repair, while they have received a great deal of consideration, have naturally been of considerably less importance than usual, because of military considerations. Aerial warfare is more or less an informal racing proposition without any particular rules, and with the life of the pilot frequently paying for defeat. The question of first cost and the cost of maintenance, therefore, cannot be given the same consideration as in the more commercial motor car field.

It is the striving for light weight and compactness that has resulted in the various radial engines, as well as the V-type engines. It has also resulted in the development of improved forms of cylinder construction, this being a point where the greatest weight saving could be made, cast-iron cylinders due to the inherent weakness of material and methods of fabrication being extremely heavy in proportion to the work performed. The steel cylinder has become almost universal in military engines for these reasons, being formed with radiating fins in air-cooled engines and provided with suitable waterjackets in water-cooled engines.

In the water-cooled engines, two pretty definite types of construction have come to the front. The Mercedes type, in which a complete cylinder unit, including the water-jackets, valve-ports and other fittings, is made up of various parts, all of steel, in most readily machinable forms, these parts being welded together. A very large number of successful engines, including our own Liberty engine, have been constructed in this way. The second system first came into large and successful use in the Hispano-Suiza engines. In this system, the cylinder wearing surfaces are of steel, while the water-jackets, valve-ports and other parts are cast aluminum. A number of interesting modifications of the Hispano-Suiza design have recently been proposed and some of them undoubtedly will prove to be successful.

It might at this point be interesting to the members to hear that we have recently completed an engine similar to the 300-hp. Hispano-Suiza, the only difference being in the use of a steel cylinder construction, and that the weight of the two engines proved to be almost identical, the one with steel cylinders being slightly heavier dry than the one using the aluminum casting construction, but the weight with the jackets filled with water is almost identical because of the smaller amount of water carried in the steel-cylinder unit.

More Aluminum-Alloy Pistons

There has been a steadily increasing use of aluminum-alloy pistons in aviation service, partly due to the light weight, but more because of the very much improved cooling due to the high heat conductivity of this material.

Of course, crankshafts, crankcases, bearings, etc., are considerably lighter for the horsepower developed in aviation engines than in pre-war automobile designs. We must remember, however, that aircraft engines are not subjected to external shocks and vibrations to anything like the extent that automobile engines are, and, furthermore, that quietness of operation can be absolutely disregarded. If we add to these facts the point already stated, that durability, ease of manufacture and of repair have been sacrificed to a considerable extent to the saving of weight, we can reach a more just estimate as to the possible value of such improvements in future automobile designs.

A contributing factor to the lowering of the power-weight ratio has been the ability reached to maintain very high mean effective pressure in large-size cylinders. A number of very light engines are successfully developing 45 hp. per cylinder and are able to maintain this power for hours at a time. Mean effective pressures as high as 130 lb. are being maintained on cylinders having piston displacements of 140 cu. in., with compression ratios of 5.35 to 1.

There are two other things which have assisted in lightening engines, these being greatly increased power, which means that planes no longer need to be operated continuously with wide-open throttle, and that much of the flying is being done at considerable altitudes. This latter feature is being done at considerable effect on the reliability and life of all aircraft engines. Various schemes have been tried out with the view of obviating the loss of power with altitude in aircraft engines, but naturally such devices have no practical bearing on automobile work.

Another line of development which has a very direct bearing on automobile engine design was just coming to the front at the end of the war. This is the production of composite

fuels. The admixture of one part benzol with four of gasoline raises the ignition temperature of the mixture to practically that of benzol. This allows of increasing compression ratios far beyond anything that is feasible with gasoline alone. While this is of undoubted value in connection with the very high grade gasoline used for military aviation, it has a far greater interest in connection with the very much less volatile gasoline daily used in automobiles. The temperature at which gasoline ignites becomes lower and lower as less and less volatile grades are used. While we can look forward very hopefully to the effect of this new fuel development in automobile work, we must not forget that it does not solve the questions of vaporization and distribution, which are always present in using gasoline having a high boiling point.

Use of Improved Materials

Regarding the question of materials, the recent advance in aircraft engines can, I think, be attributed almost entirely to a more general knowledge of materials already in use before the war. Very much higher grade aluminum castings are required than were commercially possible several years ago. Improvement came rapidly with the increasing Government demands, but it was due to greater care and better methods rather than to any new inventions.

The same situation holds good with regard to the various steels required. In the Hispano-Suiza engine we are using steels exactly the same as we used in motor cars for the last ten years, with the exception of exhaust-valve material. The use of steel having a chromium content of 12 per cent, the so-called "stainless" steel, has, because of its non-oxidizing properties at high temperatures, been very satisfactory in exhaust valves. The Liberty engine also requires no fancy materials for its successful operation. The main thing is that information regarding the manufacture, heat-treating and testing of alloy steels is much more widely distributed than before. Personally I have learned that the fabrication of the steel to be employed is far more important than the analysis. For example, a carelessly manufactured chrome-nickel steel is a snare and a delusion. I have often felt like building one Hispano-Suiza engine using nothing but straight carbon steel throughout, provided I could get such steel fabricated with the care used in making alloy steels. I have very little doubt that such an engine would stand up in direct comparison with our regular product.

There is another point of vital importance in aircraft engines, and that is the main and connecting-rod bearings, especially the latter. I think that we have learned a great deal about making babbitt-lined bearings with bronze or steel backs since the war started, but we have been able to get excellent results with the same grades of babbitt and bronze as were used before the war, improvements being made in the method of fabrication. We have run our 300-hp. engine for hours at a time, taking from 75 to 85 hp. out of it per crankpin. Each of these bearings is about 2½ in. long, disregarding fillets, and 2⅛ in. in diameter. These engines, when run at sea level, preignite practically all the time, the best power being obtained in this manner.

Heavy Babbitt-Lined Bearing Used

We have come to the use of a rather heavy bronze back babbitt-lined bearing for this work, with sufficient oil circulation not only for lubrication but for cooling also. The smaller Hispano-Suiza engine, as well as all the engines that I have ever designed, had very energetic circulation, being far beyond immediate lubrication requirements. When the 300-hp. type was being developed the oil consumption ran very high in the early samples, and there was a suggestion from the other side to remedy this by reducing the oil flow through the crankshaft. We believed this to be a mistake, and that no such action would be necessary with proper cylinder and piston design, and this proved to be the case. With the best that we can do, in lubrication and cooling, however, unless there is a 100 per cent bond between babbitt and bronze, the bearings will not stand up, the babbitt cracking and flaking off after longer or shorter periods of operation. From our own experience we have concluded that all efforts to hold the babbitt mechanically, as by the use of holes, dovetails or screw threads, for example, accomplish no good purpose, the trouble with most of them being that they are more or less local, and also that they make rapid variations from point to point in the cross-section of the babbitt. The screw-thread system possibly has not these defects, but it has two others; first—the difficulty of getting absolute cleanliness, and second—the probability of entraining air when pouring the babbitt. After all is said and done, the one sure method consists of absolute cleanliness. If the bronze is unoxidized and the tinning is maintained in an absolutely unoxidized condition until the babbitt is poured, nothing else is required to make a thoroughly satisfactory job.

We must not overlook in this discussion the question of ignition. With detailed improvements in engine construction, higher and higher compressions have been successfully used and necessarily higher and higher explosion temperatures. In modern aviation engines, spark plugs which will run successfully in automobiles for thousands of miles without attention fail in 5 min. of full-load operation. The spark plug is a study in itself, being a beautiful compromise between running so cold that it will become fouled with oil and running so hot that it will cause preignition, or that its insulating properties will break down, causing delayed ignition or misfiring. Tremendous advances have been made in the quality of insulating material and in the detailed design of plugs, which will undoubtedly have a tendency to improve the product for automobile uses.

The effect of steady high-speed running with accompanying shocks and vibration on magnetos, especially of the eight and twelve-cylinder types, has forced a very great improvement in detail manufacture in this line. It is unbelievable that it will not have its effect on subsequent commercial manufacture. I think this is equally true of the battery ignition systems, which have come into successful use on aircraft engines during the war.

Because of the very high operating pressures and temperatures, valve or piston leakage in aircraft engines becomes a most serious matter. No new inventions in piston rings have been required to meet this condition, but simply a higher grade of fabrication on already standard lines.

In the accessory field, the design of radiators has been given a new impetus. In many motor cars the radiator, due to different features of design, is larger than is absolutely necessary and the most efficient types of cores have not been required.

Radical Changes in Design Unlikely

Looking back over the facts brought to your attention in this paper, I feel certain you will agree with me that there is no reason to expect any radical change in automobile design, due to aircraft engine development. Nearly every feature of design that I have described has been used in motor cars. For instance, an eight-cylinder V-type engined car was actually produced by E. R. Hewitt in 1908, following the idea first put into service in the Antoinette aviation engine. I do expect to see an increase in the number of valve-in-the-head engines, due in part to the general efficiency of this arrangement, but more especially to the fact that this construction lends itself extremely well to the separable cylinder head, which is coming into continually greater and greater use. We have already seen a number of successful engines with cast-aluminum block-cylinder construction and this development may be expected to continue.

I have purposely based my consideration of this subject on the commercial use of motor cars for passenger and freight service. In racing cars, of course, the effect of aviation engine progress is bound to be extremely marked, as the service required is very similar in the two cases. In commercial motor car work, however, the percentage of the total loaded weight which can be saved by detail lightening of the engine is not very great, and this saving is apt, as I have pointed out, to be at the expense of durability and ease of construction and repair.

Furthermore, in my opinion the motor car engine should be designed to develop its best pulling characteristics at considerably lower speeds than does the aircraft engine, which will undoubtedly mean very much lower compression ratios and lower mean effective pressures.

The Liberty Aircraft Engine*

A Chronological History of the Development of the Liberty Engine, with Sidelights on Incidents and Military Requirements That Affected Its Design

By J. G. Vincent
Vice-President in Charge of Engineering, Packard Motor Car Co.

UP to the time the armistice was signed, the Government maintained a strict censorship over details of its war equipment, and for this reason very little was known about the details of the Liberty aircraft engine outside of military circles. Since the signing of the armistice this censorship has been lifted, and very complete detail information covering this engine has been published. The cuts and data already published are quite accurate, and hence it seems unnecessary to give a detailed description in this paper.

It was decided to divide this paper into two parts, covering, first, the historical side of the Liberty aircraft engine; and second, a discussion of its features, explaining how these features worked out in actual practice, and what changes in the construction would appear to be desirable after extensive experience with thousands of these engines on the test stand, at the test flying fields, at the schools and on the battle front.

The historical side of this development is, in my opinion, one of the very best arguments for reasonable preparedness, and I don't think that, as an engineer, I would be doing my full duty to this Society or to our country unless I gave my brother engineers as complete a picture as may be possible of the difficulties encountered due to lack of preparedness in our Air Service when war was declared on April 6, 1917.

I urge all members of the Society to give this matter careful thought and do everything in their power to further the development of military aeronautics in this country, as we may not be so fortunate the next time in having allies to stand between us and the enemy while we spend a year laying the fundamental basis for an Air Service, as was the case in the recent emergency.

I will endeavor to set forth clearly just what happened in extensive use of the engine. It may well be that all engineers will not agree with me in some of my conclusions, but I will endeavor to be entirely unprejudiced, and my statements will be based on what I believe to be the consensus of opinion of the many experts with whom I was associated in the Engineering Division of the Bureau of Aircraft Production at the time the armistice was signed.

Aircraft Situation When We Entered War

To understand why certain moves were made it is necessary to have a clear picture of the aircraft situation as it existed in this country when we entered the war. We were totally unprepared. The Government had no adequate engineering organization, no production organization, and no samples or drawings of engines, airplanes, instruments or armament of any value for military operations on the battle front; neither did it have any definite information regarding designs being used by our allies. We had to start from absolutely nothing. Realizing the seriousness of the situation, General Squier immediately arranged a number of very important moves, and realizing that the obtaining of proper equipment was very largely a commercial matter, he gathered around him a small group of men of undoubted engineering and business ability. Among these were Howard E. Coffin, Edward A. Deeds and S. D. Waldon. These men, together with General Squier and a few others, began immediately to operate as an Aircraft Production Board.

One of the first moves of this Board was to arrange to send a commission abroad to study airplane designs, make recommendations covering machines to be copied, and put into production, and send information about such machines to America at the earliest possible moment. Major R. C. Boling headed this commission, and took with him Captain Clark, an airplane engineering expert, and Howard C. Marmon, an engine expert. Captain Clark had been head of the very small airplane engineering organization which existed as a part of the Signal Corps at the beginning of the war, and he was chosen because he was as well posted on this subject as any other man in America. Howard C. Marmon was chosen as he had had a long experience on automobile engines and was a highly-trained all-round engineer. He resigned his position with the Nordyke & Marmon Co. to take up this work, at the personal request of General Squier, and he was commissioned as a Captain in the Reserve Corps after he had been in Europe for some time. This commission left for Europe about June 15, 1917. While these preliminary moves were being made in this country, our allies, realizing our state of unpreparedness, had sent a Technical Commission to this country to act in an advisory capacity so that we might get something started along the right line with the least possible delay.

Allied Technical Commission Came Over

A combined group of French and English experts visited Detroit on May 26, 1917. I conducted them through the Aircraft Engine Experimental Department of the Packard Company, and explained the development work that had been carried on in there for two years. They seemed to be very much pleased with the quality of the work and the general details of design of the Packard aircraft engine, and stated that it would no doubt be a very fine engine for certain kinds of work, but that its power-weight ratio was too great to make it of any real value in an up-to-date military airplane. The engine would develop about 235 hp., and without water or radiator weighed a little under 3½ lb. per hp. We had a very thorough discussion of the aircraft situation, and the commission gave us many valuable hints in connection with the latest developments in Europe. I realized that there was not a single firm in the United States working on aircraft engines that would be of any real value on the fighting line.

I read later that there were at that time about thirty-seven different kinds of aircraft engines being manufactured or experimented upon in England and some forty-six different kinds in France.

This multiplicity of design not only made for high price and low production, but also caused great complication in the field, as it was next to impossible to keep on hand proper repair parts for all types of engines.

I discussed the situation with the president of the Packard Motor Car Co., who appreciated the need for a standardized line of aircraft engines, and suggested that we communicate with Mr. Coffin. I left Detroit for Washington on May 27, in company with R. D. Chapin of the Hudson company. We had a conference with Messrs. Coffin, Deeds and Waldon. I pointed out the absolute impossibility of obtaining a large production of aircraft engines in this country if the various factories were left alone to go their own way in the designing

*Read at the annual meeting of the Society of Automotive Engineers.

of aircraft engines. I told them that if it was going to be necessary for the automobile industry to build a large number of aircraft engines they must be furnished with a proper standardized design, so that they would not have to waste any time in experimental work. I pointed out the fact that the Packard engine was too low powered and too heavy, but that this could easily be remedied by increasing the piston displacement and lowering the factor of safety. I explained that this engine had been designed to weigh under 4 lb. per hp. and run for the longest possible time without overhaul, and that it was the result of specifications put up to me by the Government about two years before, but that since then aircraft development had been rapid, with the result that conditions were entirely changed. I pointed out that the French and English commission had stated to me that a fighting airplane must be equipped with an engine of the lightest possible weight per horsepower, which meant that it must be designed with the lowest possible factor of safety that would run satisfactorily for a reasonable length of time.

Designing the First Engine

After discussing the matter at some length, Mr. Deeds suggested that he would like to have me meet E. J. Hall. On May 29, Mr. Deeds, Mr. Hall and I got together, just before noon, at the New Willard Hotel, and went carefully into the situation so that we might make a joint report on the aircraft engine situation in this country promptly. By mid-afternoon Mr. Hall and I were ourselves laying down two views of a proposed eight-cylinder aircraft engine.

To get started promptly, we called Mr. Zimmerschied, who was then running the Society's Washington office, and asked him to get us a draftsman and some drafting materials. He could not locate a draftsman, but sent over his own drafting instruments. We purchased drafting tables and supplies, and soon were busy. I laid out a transverse section, and Mr. Hall a longitudinal one. We were very well posted on all engines manufactured in the United States and also a great many of the foreign makes, but we, of course, also wanted the latest information on British and French engines. We appealed to Major Souther of the Signal Corps and he immediately put Charles King on the job of rounding up this information for us.

That evening Mr. Deeds called a session at the New Willard, at which members of the French commission were present. By this time Mr. Hall and I had specific questions that we wanted to ask, and they were answered quite fully by the French officials. The next morning Mr. Zimmerschied turned one of his volunteer helpers over to us, Mr. Schoonmaker of Pittsburgh. Like Mr. Hall and myself, Mr. Schoonmaker had done no drafting work for a number of years, but nevertheless he did not hesitate to take off his coat and go to work. I turned the drawing that I was making over to Mr. Schoonmaker, and proceeded to dictate a report to the Aircraft Production Board, which Mr. Hall and I had agreed on the night before. I reproduce this report below, as I believe it clearly sets forth our understanding of the situation at that time:

First Report to Aircraft Production Board

At your request we have made a careful study of the aircraft engine situation, and hasten to submit our report:

To get this report in your hands promptly, we have condensed it as much as possible, and have covered the essentials only. In view of the fact that there are a number of good engines for training machines available, we have disregarded this type of engine, and we have confined our attention strictly to the high efficiency, low weight per horsepower type, such as is necessary at the front.

In order that any engines that are built by this country may be of any value when received at the front, it is, of course absolutely necessary that their efficiency be brought up to, or a little beyond, the best now available in Europe. The French and English Commissions have enabled us to obtain this information by answering our questions very clearly and completely. From information obtained from these gentlemen and from other sources, we believe that the Lorraine-Dietrich is the coming engine in Europe. This engine has not been built in large quantities as yet, but some thirty have been constructed and carefully tested out at sea level, and also at about 6000 ft. elevation.

The important facts about this engine are as follows: Eight cylinders, 120 mm. bore by 170 mm. stroke; cylinders made of steel with water jackets welded on. Engine is direct-driven and develops 250 hp. at 1500 r.p.m. and 270 hp. at 1700 r.p.m. The weight of the bare engine is 240 kg., or approximately 528 lb., while the weight of the engine complete, with radiator and water, is 305 kg., or 671 lb. There seems to be a reasonable doubt regarding the exact weight of the bare engine, as, while the French Commission gave us the figure of 528 lb., information from other sources indicates a weight of 552 lb. Probably some intermediate figure is more nearly correct, but in any event the engine gives a horsepower for approximately 2 lb. of weight when figured at its maximum output of 270 hp.

After obtaining this information and considering the matter very carefully, we next investigated the manner of testing such an engine, as we knew that an engine of this type could not be run at full power for long periods of time without developing serious trouble. Here again the French Commission gave us valuable information. They stated that in using an engine of this type it is only run at full power for short periods of time, while climbing or fighting, and that at all other times it is run at speeds 200 to 300 r.p.m. slower. In view of the fact that the engine is built to run under these conditions it is, of course, necessary to test it under a similar condition, and they stated when trying out a new model of engine it is their practice to mount a propeller which will just hold the engine down to maximum speed under full throttle. The engine is then run for 50 hr. in periods of 6 to 8 hr. each, but the engine is not run up to full speed for more than a total of 10 hr. during this entire period, nor is it run more than 30 min. at any single time under this condition. The other 40 hr. running is under throttled condition, turning the same propeller at 200 to 300 r.p.m. less than maximum speed.

This information is of the utmost importance, as it enables us to reduce all factors of safety and makes possible the light weight per horsepower now being obtained in Europe. After obtaining this information, we immediately laid down a proposed engine, which we believe can be produced promptly in large quantities in this country. Built carefully out of proper materials, this engine will have approximately the following characteristics and be as good, or a little better, than the Lorraine-Dietrich, which is not as yet really available abroad. In laying down this engine we have, without reserve, selected the best possible practice from both Europe and America. Practically all features of this engine have been absolutely proved out in America by experimental work and manufacturing experience in the Hall-Scott and Packard plants, and we are, therefore, willing to stake our reputations on this design unhesitatingly, providing we are allowed to see that our designs and specifications are absolutely followed.

The engine is to be of the eight-cylinder type, with cylinders set at an included angle of 45 deg. The cylinders are of the individual type, made out of steel forgings, with jackets welded on. The bore is 5 in. and the stroke 7 in., giving a piston displacement of 1100 cu. in. The crankshaft is of the five-bearing type, with all main bearings 2⅜ in. in diameter and all crankpin bearings 2¼ in. in diameter. The connecting rods are of the I-beam straddle type. This engine is of the direct-driven type with a maximum speed of 1700 r.p.m. This engine will have a maximum output of 275 hp. at 1700 r.p.m. It will weigh 525 to 550 lb., but we feel very sure of the lower figure. It will have a gasoline economy of 0.50 lb. of fuel per hp.-hr. or better; it will have an oil economy of 0.04 lb. of oil per hp.-hr. or better. Complete with water and radiator, this engine will not weigh more than 675 lb., if a properly constructed radiator is used and placed high above the engine. To obtain the above mentioned weights, it will be necessary to use the fixed type of propeller hub, which has been thoroughly proved out by Hall-Scott practice. It will also be necessary, as mentioned above, to use the very best material, workmanship and heat-treatment.

Complete detail and assembly drawings, as well as parts lists and material specifications, can be completed at the Packard factory under our direction in less than four weeks. We believe that a sample engine can also be completed in approximately six weeks, if money is used without stint. As soon as the drawings, specifications and a sample engine have been finished, complete information would, of course, be available, so that any high-grade manufacturer could either make parts for this engine or manufacture it complete.

In laying down this design, we have had in mind the extreme importance of interchangeability, as a well laid comprehensive program, which has for its base interchangeability of important parts, such as cylinders, will speed up output and reduce ultimate cost to an astonishing extent. Europe is suffering right now from lack of uniformity of design, but it is too late for them to change their plan. We

however, can take a leaf out of their book and start right.

In the design which we have laid down, the cylinder, for instance, can be used to make four, six, eight and twelve-cylinder engines. As this is the most intricate part to make, immense facilities could be provided to produce them in large quantities for the use of many concerns who could manufacture the rest of the engine. Nearly all small parts, and numerous large and important ones, would also be interchangeable. This would not only speed up production, but would be of the utmost importance in connection with repairs and replacements. A full line of engines made according to this plan would line up about as follows:

Type	Rated hp.	Maximum hp.	Weight, lb.	Weight per hp., lb.
4	110	135	3.5	2.7
6	165	205	400	2.8
8	225	275	535	1.9
12	335	410	710	1.7

Respectfully submitted,
(Signed) J. G. VINCENT.
(Signed) E. J. HALL.

The above report was finished on the afternoon of May 31, and we had at that time gotten the cross-section and longitudinal section drawings fairly well blocked out. About 3 p. m., Mr. Waldon telephoned Mr. Hall and me to bring our report and drawings over to General Squier's office, in the Army and Navy Building. When we arrived we were promptly shown in the conference room, where a joint conference of the Army and Navy and Aircraft Production Boards was in session, with Mr. Coffin in the chair. Mr. Coffin called for our report, and we asked Mr. Waldon to read it.

Actual Layout Work Started

After the report was read we were asked to explain the drawings, which we did as quickly and clearly as possible. We, of course, explained that these drawings were only intended to show the general idea, and that we would, however, get layouts made quickly if our suggestions met with favor. We were immediately requested to go ahead with all possible haste and make good layouts. We wired to Detroit for two good layout men, and they arrived about noon Friday, June 1. Messrs. Hall, Schoonmaker and I kept right ahead with our layouts, on which we were determining construction features. This allowed good layout men to go right ahead with finished layouts of settled construction. We all worked right straight through until Monday afternoon, June 4. By that time the layout men had finished good, accurate layouts of the longitudinal section, transverse section, rear elevation and camshaft assembly views of the eight-cylinder engine.

About the middle of the afternoon of June 4, Mr. Hall and I were again requested to go before the joint committee of the Army and Navy, with the Aircraft Production Board, to make a further report. We exhibited the finished drawings and went somewhat more into detail than had been possible at the previous meeting. After we had explained the drawings we left the conference with Mr. Deeds, who was just leaving for Dayton. Mr. Deeds told us that it had been decided that we should build ten sample engines, five of the eight-cylinder size and five of the twelve-cylinder, and asked us to "go to it" and produce the first sample eight-cylinder engine at the earliest possible moment. He told us he had promised that we would finish the first sample eight-cylinder engine in seven weeks from that date. We immediately sent the layout men home to Detroit with instructions to complete the detail drawings of the long-time parts, such as cylinders and crankcase, immediately.

Mr. Hall went to Indianapolis that night and I went to New York, where I met Mr. Macauley the next morning and explained to him just what had taken place. Mr. Macauley and I returned to Washington on the morning of June 6, and immediately went into conference with Messrs. Deeds, Waldon and Hall. Mr. Deeds explained to Mr. Macauley the great advantage of standardizing a line of U. S. A. engines, and after a little thought Mr. Macauley not only agreed to this very radical step, but also to the loan of my services to the Government for a period of three months so that I might follow up the engineering work which had been started.

Mr. Deeds explained to Mr. Macauley that money had been appropriated to cover the cost of this development, but that he realized that to make good on the deliveries which he had promised I must have the ability to order things quickly through commercial channels, with which I was well acquainted. To this end he requested Mr. Macauley to arrange for the Packard Motor Car Co. to "finance the job," so to speak, or, in other words, to buy and pay for anything which I requested for the work, with the understanding that the Packard company would render an accounting, and be reimbursed by the Government. Mr. Macauley agreed to do as requested, stating that this work would be put ahead of anything in the factory, and that I would have the "right of way," not only as to the services of my well-trained experimental organization, but the factory facilities also. This was the day on which the "U. S. standardized aircraft engine" idea was really settled.

Originally It Was the U. S. A. Engine

As a matter of interest, I will state that Mr. Hall and I designated this line of engines as the U. S. A. standardized line, but a little later I believe Admiral Taylor "dubbed" it the "Liberty" engine in one of the Aircraft Board meetings, and this name took so well that we were forced to adopt it, and change all our titles on the drawings.

Mr. Hall and I left Washington Thursday noon, June 7, for Detroit, where we arrived on Friday morning. We went to the Packard factory and looked over the work on detail drawings which had been started. We found that O. E. Hunt had taken very prompt action, and already secured billets of steel from Cleveland out of which to make cylinders for the first engines. Mr. Hall spent the day going over various matters with me, and left on the night boat for Cleveland to make arrangements to get crankshaft forgings for the first engine. These forgings, completely heat-treated, were produced in three days, Mr. Hall having given permission to "dig out" his dies.

I, of course, realized that to get the first engine quickly we must have detail drawings almost immediately, and I therefore called for volunteers from the various drafting departments of the Packard organization to work Saturday afternoon and Sunday. Every man volunteered, with the result that we had a very large force working Saturday afternoon and Sunday, and during this day and a half approximately 86 per cent of the detail drawings were finished on vellum, from which blueprints could be made. In other words, on the morning of June 11 I was enabled to get blueprints of 86 per cent of the parts, and I immediately began calling on various automobile and accessory manufacturers to rush through enough parts for a first sample eight-cylinder engine.

The crankcase upper and lower halves were, of course, long-time parts, and these drawings could not be finished in a day and a half. We did, however, succeed in getting them nearly enough completed by Wednesday, June 13, to enable us to take off preliminary prints. These preliminary prints enabled us to start pattern work and also a wood model of the engine. Vellum drawings of the upper and lower halves were finished on Friday, June 15, and good blueprints were put in the hands of the experimental pattern shop.

In the meantime, the pattern shop had been working night and day on the wood model, which they succeeded in finishing and shipping to Dr. Stratton at the Bureau of Standards, on Saturday. By this time the vellum drawings on all the major parts, except those contained in the oil-pump assembly, had been completed, and enough parts for a sample engine ordered from various factories.

Assembling an Engineering Organization

While all this work was going on during the week ended June 16 the Aircraft Production Board was furnishing engineering offices at the Bureau of Standards, Washington, where space had been arranged for by Dr. Stratton. I left Detroit on Sunday, June 17, with a complete engineering organization, which had been drawn from various automobile factories, including the Cadillac, Dodge and Packard. Engineers were also sent from the Pierce-Arrow plant, and

they met us at Washington. I arrived in Washington on Monday morning and immediately set to work getting settled in our new quarters at the Bureau of Standards.

In order to "put over" a job of this magnitude in a short time a tremendous amount of work must be accomplished quickly through the co-operation of a great many people who are peculiarly fitted by their training to do their particular part without detailed supervision. At this stage the design was practically settled and the work of building samples was well under way. Everybody connected with the job continued to put forth his very best efforts, with the result that our first sample Liberty engine was delivered to the Bureau of Standards, Washington, on July 3, 1917. Additional samples of the eight-cylinder, also samples of the twelve-cylinder, followed quickly, and the first sample twelve-cylinder Liberty finished its first official 50-hr. run at 1.30 a. m., Aug. 25, 1917, having gone through this 50-hr. run in an elapsed time of only about 55 hr., thus breaking all records for tests of this kind. It is usual to run such tests in periods of 5 hr. each, two runs being made each day. In other words, it usually takes five or more days to complete such a test. This 50-hr. test was made under the supervision of Government Inspector Lynn Reynolds, and after finishing his very complete report of the test, he wrote the following foreword:

The appended report is a survey of the main phases of the 50-hr. endurance test, maximum power curve calibration on electric dynamometer, and inspection of dismantled parts of U. S. A. twelve-cylinder aircraft engine No. 1, which were made under the supervision of the Equipment Division, Signal Corps, at the Packard factory, Detroit, Mich., Aug. 22 to 25, 1917.

A consideration of the data collected, we believe, will show that the fundamental construction is such that very satisfactory service with a long life and a high order of efficiency will be given by this power plant, and that the design has passed from the experimental stage into the field of proven engines.

The First Engine Completed

All the Government officials who had been following this job carefully realized that while no doubt a great deal of detail work remained to be done, this test conclusively proved that we had an engine design capable of being produced in large quantities in this country, and that it would compare favorably with the best designs that had been developed in Europe. Acting on this belief, all possible haste was made in cleaning up the drawings, and a complete set of drawings of both the eight and twelve-cylinder designs were turned over to Lieutenant Emmons, who was in charge of Engine Production, about Oct. 1, 1917. It was, of course, understood that many detail changes would have to be made in these drawings during the early stage of manufacture.

After careful consideration of reports from abroad it was decided to put the twelve-cylinder engine into production and hold the eight-cylinder back, as all demands from abroad called for around 400 hp. The first "production" twelve-cylinder engine was delivered at McCook Field, Dayton, Ohio, on Thanksgiving Day, 1917, but it should be borne in mind that this engine was only partially made from production tools. In fact, the first several hundred engines were made more or less by hand to get out a reasonable quantity at the earliest possible date, and thus permit extensive tryouts under actual flying conditions.

During the time that this work was going on, Captains Clark and Marmon returned from Europe, and after going over the Liberty engine carefully in light of what they had learned, agreed that we had been very wise in developing the Liberty engine, because, in their opinion, an engine of 400 hp. was essential for types of machines that it had been decided we should manufacture, and they stated that no proved 400-hp. engine existed in Europe.

Spurred on by this encouraging information, every one concerned put forth his best efforts to get into quantity quality production at the earliest possible date. From this point on the facts are pretty generally known. As soon as the necessary samples could be shipped to Europe they were carefully tried out under actual flying conditions by our allies. First England, and then France and Italy accepted the engine and began to negotiate for the purchase of these twelve-cylinder Liberty engines for installation in their planes. Unfortunately, our own plane production was considerably delayed, not so much on account of the plane itself, but because of the fact that we did not have in this country the necessary instruments and armament to equip the planes. In other words, the design of the De Haviland Four could have been finally settled in November or December, 1917, had information been available as regards all the instruments and armaments, but this information did not become available until late in March, 1918. As soon as this information was available the De Haviland Four design was quickly cleaned up, and I believe that a real record was made in getting it into production after that time.

What the Tests Revealed

As soon as these planes became available they were extensively tested both in this country and abroad, with the result that numerous minor faults were developed, which had to be corrected. The extensive test work of the Liberty-De Haviland combination also developed several shortcomings in the Liberty engine, which had to be corrected after production was fairly well under way in one plant. In this connection, however, it is interesting to note that the correction of none of these difficulties involved any radical change in the basic design.

It is now a well-known fact that the De Haviland plane equipped with the Liberty Twelve did wonderful work at the front, and that it was considered the best all-round plane available at the time the armistice was signed. It is also a significant fact that England, France and Italy were taking deliveries of these engines just as fast as they could get them, and installing them in their various types of observation, two-seated fighting, day bombing and night bombing machines.

The fact that no tried 400-hp. engine existed in Europe was one good reason for developing the Liberty engine, but other equally good reasons existed. The engines developed by our allies had been built under extreme pressure. There were so many different kinds that none of them were made in any great quantities. Probably the two best foreign engines at that time were the Rolls-Royce and the Hispano-Suiza. According to information received at that time, the Rolls-Royce developed about 350 to 375 hp. and was recognized as probably the best large engine available for our allies. It was, however, developed for European manufacture in small quantities, and was composed of a great many intricate parts, which would be very hard to manufacture in quantity under American production conditions. For example, many of the important forgings would have to be made much better than it had been our practice in this country. The Liberty engine was designed to be as reliable as Rolls-Royce, develop a little more power, be a little lighter per horsepower and cost about one-half as much. These aims have all been accomplished.

The Hispano-Suiza was a smaller engine, and as it was already in production in this country, and continued to be produced in increasing quantities, it need not be considered in this discussion.

Lorraine-Dietrich Held Up As Model

The Lorraine-Dietrich eight-cylinder engine, which it will be remembered was held up to Mr. Hall and me as the coming aircraft engine in Europe, did not come through the experimental stage as fast as had been anticipated. While Captains Clark and Marmon were in Europe they examined both eight and twelve-cylinder models of this engine, but upon their return stated that it had not yet gone into quantity production, and as nearly as they could determine these engines were still in the experimental stage. Our Government had for months a standing order to ship one of the twelve-cylinder Lorraine-Dietrich engines to us, but it was never received. It is obvious, therefore, that it would have been a great mistake to have depended on putting either of these Lorraine-Dietrich engines into production in the United States.

The only other Allied engine that looked at all interesting was the Bugatti, and arrangements were made to bring a sample of this engine to America, so that it might be put into

production. As was to be expected, it had to be entirely redesigned for American methods of manufacture, with the result that it was just getting into production when the armistice was signed. This engine was designed for a special type of service and can never be as light per horsepower as the Liberty. It may, however, have distinct military value for certain kinds of work.

A Standardized Line of Engines

To sum up what has been accomplished by the designing of the standardized Liberty aircraft engine, I will state that this development made it possible for the United States to produce large quantities of 400 to 420-hp. reliable light-weight aircraft engines. Handling of the maintenances problem was greatly facilitated, with but one set of repair parts for the vast number of engines manufactured.

I am not in possession of exact information regarding production, but I know that the first production engine was delivered to the Government in less than six months from the date that Mr. Hall and I turned in our original recommendation, and within a year from the date our recommendation was made some five or six large companies were in quantity production, and the output was increasing steadily day by day.

Had the war gone on for a few more months, we would have also been producing the 280 to 300-hp. Liberty Eight in large quantities for single-seated fighting or chasse machines. To take care of the maintenance work on these eight-cylinder engines, it would have been necessary to put into stock only some twelve additional parts, as the eight-cylinder parts are interchangeable with the twelve-cylinder, except as to a few special parts such as the crankcase, crankshaft and the like.

An important advantage of the standardized line of engines, which is ordinarily overlooked, is the matter of installation in planes. To be a good job, all airplanes must be designed around the engine and equipment. Every different type of engine presents many new installation difficulties. We have worked out a standard form of installation for the standardized line of Liberty engines, so that we could give a plane designer definite information as to the engine tachometer, the gasoline system, the oil system, cooling system, the spark throttle and altitude control system, and many other details too numerous to mention.

Standardization and Reliability

I have talked with many experts who have been sent over by our Allies, and all who have had practical experience at the front state emphatically that the most important thing about a military airplane is to have it reliable, and they, therefore, agree with me that it is very important to have all the systems standardized as outlined above so that the troubles may be worked out of them. They have stated to me that it has never been possible to work out good standardized systems abroad, on account of the fact that they have had so many different kinds of engines to install. Due to this fact, most of their installations have been more or less of a makeshift, and a very large percentage of their failures have been due to failures of some part of these systems, rather than to the engine or plane proper.

I hope that I have made the matter of standardization clear, as I consider it of the utmost importance, but I do not want to be understood as advocating that the Government use only one or two kinds of engines during peace time. The standardized Liberty aircraft engine was designed to meet an actual emergency, and I believe that everybody who is familiar with the facts will agree that it was a very wise move. On the other hand, it would greatly retard development if the Government did not give careful and unprejudiced consideration to all designs submitted during peace times. If there is to be any real progress in the development of aircraft engines, airplanes or airplane equipment, however, it must be brought about by the co-operation of engineers and proper officials of our Government.

At the present time the Engineering Division of the Bureau of Aircraft Production and the Technical Section of the Department of Military Aeronautics are being merged into one peace-time organization, which will probably be known as the Technical Section of the Department of Military Aeronautics. This reorganization is being carried out under the direction of Col. T. H. Bane, of the Air Service, whom I personally know to be well fitted for the job, on account of his long training in the army, his knowledge of military aeronautics and his thorough broad-mindedness and impartiality.

The Technical Section of the Department of Military Aeronautics is a mammoth bureau of information, having on file at the present time a complete record of the present state of the art, not only in this country, but in all important foreign countries as well. In addition to serving as a bureau of information, this section, through its officers, acts in an advisory capacity to engineers, as critic of designs or sample machines, and last, but not least, as an experimental organization to test out all designs which are submitted. By co-operating with this department, all engineers may secure exactly the same data and advice, and be sure that their equipment will be tested in an unbiased, as well as in a standardized, way. In other words, all engineers will have exactly the same chance, and may be posted beforehand as to just what tests their equipment will have to pass through.

Much Depends on Proper Support

If the Department of Military Aeronautics is given proper support, as it must be if we are to remain prepared in our air service, the Government will be in a position to go into production quickly in any emergency, because the Technical Section will have a complete record of all tests, and will, therefore, be in a position to select the best equipment of each kind; and, furthermore, it will be in possession of the necessary drawings, specifications, etc., so that in such emergency there would be no necessity for an experimental stage.

In closing this chapter of my paper I want to urge all engineers who are interested in aeronautics to co-operate with the Technical Section of the Department of Military Aeronautics and work for the maintenance of a permanent technical department, in connection with our Air Service, so that we may never again be caught in the pitiful condition that existed in the early part of 1917.

[*The concluding part of Mr. Vincent's paper, in which are given reasons for features of the design, will be printed in next week's issue.*—EDITOR.]

Vineyard Tractors Needed in France

AMERICAN CONSUL PAUL H. CRAM, of Cette, states in a recent report that owing to the shortage of labor and horses, there exists in that district, as in all parts of France, an excellent market for farm tractors. However, it should be noted that wine-growing is by far the chief branch of agriculture carried on in that region.

In a communication to the "Académie d'Agriculture" dated Dec. 12, 1917, Mr. Ringelmann, director of the "Station d'Essais de Machines de Paris," explained the importance of the market which French, Algerian and Tunisian vineyards offered to farm tractors. The extent of the vineyards which may be cultivated mechanically is estimated at 640,000 hectares (1,581,468 acres). Mr. Ringelmann stated that at that time (in 1917) no tractors had been constructed specially adapted for use in the vineyards.

The labor to be performed in the vineyards consists of plowing to a depth of 4 to 6 in. and scarifying to a depth of 2 in. According to Mr. Ringelmann, the maximum width of a tractor should not exceed 1 meter (39.36 in.). The tractor, together with the plow or cultivator, should be able to turn around within a distance of 3 meters (9.84 ft.) at a maximum. The weight should not exceed 2400 lb. Furthermore, the tractors should be so constructed that they may be utilized for the application of sulphate and sulphur to the vineyards. In order to make use of these tractors for hoeing and weeding purposes, it would be necessary to install an appliance which would permit a modification of the distance between the wheels in order to correspond with the space between the lines of vines. The outer side of the tires of the wheels should pass at about 8 in. from the axis of the line of vines to be weeded.

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The Automobile

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The New York Show

FROM an automobile-commercial standpoint, the war came to an end at an opportune time. Had it lasted only two months longer the manufacture of automobiles for the general market would have been entirely stopped and the succession of annual shows in this city, which has been continuous since 1900, would have been broken.

It had already been decided by the National Automobile Chamber of Commerce to abandon the show this winter, but the signing of the armistice on November 11 made it possible to hold it, although the date had to be set one month later than usual. While there is thus no break in the continuity of the annual exhibitions, there has been a change in management, the show this year being conducted by the New York automobile dealers' organization instead of the National Automobile Chamber of Commerce. This change, however, will hardly be apparent to the attending public. In former years the manufacturers staged the show and the dealers from a considerable eastern territory were on hand to take care of customers from their localities. This year the New York dealer will be the exhibitor, but no doubt factory representatives will be in attendance to look after those seeking agencies. Many agency connections have been broken during the past year, partly because of the demands of the war upon the manpower of the country and partly because the manufacturers, being kept busy with war work, were unable to deliver cars. Consequently, it is to be presumed that now, when the manufacturers are again in position to devote all their efforts to the production of cars, there will be a greater demand for "territory" than there has been for years back.

It would be futile to look for striking technical innovations at the show. Up to the time the armistice was signed automobile manufacturers were looking forward to a complete stoppage of car manufacture for an indefinite period, and the minds of their engineers naturally were concentrated on problems connected with the work that was to occupy them during this period. There has not been time enough since to create anything new and put it in shape for production, hence what we are seeing at the show are the same models that were exhibited last winter. The few exceptions do not invalidate this statement.

Special Show Chassis Scarce

It is probably due to the haste with which the exhibits had to be prepared that finely finished chassis and special bodies are less conspicuous than at previous shows. The preparation of such show models demands a great deal of time and also involves a good deal of expense. A local dealer, of course, cannot go to the same expense in preparing show samples as can a manufacturer. The fact that the New York show this year follows the Chicago show, and that without interval so as to preclude the transfer of exhibits from one show to the other, may have had its effect. On the whole, the New York show this year is a plain business show at which practically none but stock models are shown. The war, moreover, has left its imprint on the show, in that not a few of the makers, in accordance with the recommendations of the Commercial Economy Board, have reduced the number of different models manufactured by them. Thus the cloverleaf and so-called sport models, which never sold in the same numbers as the standard runabout and touring car models, are less conspicuous than at former shows.

As to the success of the show, it is still too early to speak with assurance. On the opening night the attendance was good, though there was not the same jam as in previous years. However, it has always been the custom to swell the opening attendance by artificial means, and it would be unwise to take this as a criterion of public interest. As usual when the show is held in Madison Square Garden, it has a fine setting, and weather conditions at the opening also were very propitious.

Powering of Cars

AN engineer in a recent letter regretted that there are no settled standards for powering passenger cars. Most other features of design have been brought down to a well-defined basis, but nobody seems to be able to say what should be the horsepower of a car of given weight and load carrying capacity. This is the more remarkable since extension acceleration tests have been carried out in recent years. Our correspondent remarks that if there were some generally accepted standard for the amount of power that must be provided in cars of definite weight, we would not have the present great differences in the ability and liveliness of cars, for which there seems to be absolutely no warrant.

We do not believe that a uniform rule for powering passenger cars will ever be adopted. A great many drivers strongly favor "high ability"—a car capable of rapid acceleration, that responds almost instantly to the throttle. However, this quality in automobiles is rather expensive to the owner. It means the provision of an engine of great piston displacement with its attendant low fuel efficiency. Not only does an over-powered car burn more fuel per mile of travel, but its tire consumption also will be materially greater, owing to the heavy strain on the tires due to rapid acceleration.

There are many purchasers who are not aware of these uneconomical features of the super-powered car and there are others who do not mind them because they appreciate the operating qualities of such a machine. On the other hand, the war has taught most people to economize, and the maker at least knows that in order to minimize the fuel consumption the piston displacement must be kept down. Striking an average will not meet the case. There are a sufficient number of people who want a lively car regardless of cost to afford a good market for a machine of this type and there are many more who are looking for an economical car.

The designer, therefore, should first select the class of customers which he wants to supply and then power his car accordingly.

Aviation Influence

IT it remarkable that three of the most prominent engineers in our aircraft program should agree so closely in their comments on the influence of airplane engines on the design of power plants for automobiles as they did in their papers presented before the winter meeting of the Society of Automotive Engineers.

These papers, which were probably prepared independently, showed a unanimity of thought which is very rare when future practice is discussed. The matter was commented on by President Kettering from the platform and also by a great many in the audience.

Yet, are there not a good many thoughts on this subject which were not brought out? There is no doubt that engines for passenger car and truck work are going to remain much as they are, and there is no chance of airplane engine practice revolutionizing the modern gasoline engine. Nevertheless, this subject presents so many angles that it is not right to dismiss it with generalities.

Surely the experiences with the airplane type of valve have taught some valuable lessons! We must have learned something from the use of heavy section aluminum pistons, steel cylinders, pressure oiling and the general application of light-weight design which will have its influence in improvng the performance of the high duty, high-speed type of engine. Further and more detailed discussion of this subject should bring to light many matters relating principally to detail refinement but which have a marked influence on general performance.

Makers' Attitude Towards Standardization

LIKE every other movement of importance in the world's progress, engineering standardization has met with a good deal of opposition. While, on the one hand, it is being hailed as a great boon to the industry and encouraged in every way, on the other hand faults are being found continually and the work is impeded as much as possible.

It is now quite clear that standardization is a great help to the organization of large industries. Where the products of one branch of the industry have to be used by another branch and fitted to its products, standardization eliminates many difficulties. If the parts are made to certain outside dimensions with definite tolerances, not only can the purchaser be sure that they will fit when received, but in case one source of supply fails the parts can be obtained from another and used without any change in the design of the machine.

But when standardization is attempted of what may be designated the "internals" of a part, the resentment of the manufacturer is likely to be aroused. When the parts have to fit only other parts that are made in his own plant his engineering department can handle the matter alone without outside help. The situation would be a very simple one if all factories specialized to the same degree, for probably no one would force himself upon the manufacturer insisting on giving him help on what are recognized to be his own problems. But this is far from being the case. Where one manufacturer produces almost every part of a complete car, another turns out only bearing bushings or similar parts. Consequently, their respective interests are entirely different and this often explains their different attitude toward standardization.

During the early years of automobile standardization many manufacturers looked upon the movement with a great deal of suspicion, and especially were they afraid that some competitor might "put something over" on them by getting standards adopted that were right in line with his methods and designs. Very little or nothing of this sort has ever occurred, however.

Latest News of the

Manly Will Head S. A. E., 1919-1920

Society Has Had Successful Season—Increasing Membership at Rate of 1,000 Per Year—Finances in Excellent Condition

NEW YORK, Feb. 5—The annual professional section of the Society of Automotive Engineers opened to-day with an attendance which crowded the seating capacity of the auditorium of the Engineering Societies Building. Tractors, war and commercial, and an automobile engine symposium filled the day's program with the exception of a short time devoted to the business of the society, during which the new officers were announced and the financial and membership matters were shown to be in flourishing condition. The assets of the society are now $79,000.

Charles M. Manly of the Curtiss Aeroplane & Motor Corp. will head the S. A. E. for the 1919-1920 term. B. B. Bachman, chief engineer of the Autocar Co., will be first vice-president. The other officers are: Second vice-presidents, E. H. Belden, E. A. Sperry, T. B. Funk, John J. Armory and L. S. Kielholtz, representing, respectively, the motor car, aviation, tractor, marine and stationary engine fields. The following have been elected as councillors for 2 years: E. A. DeWaters, David Fergusson, E. A. Johnston, and for 1 year Charles S. Crawford and J. B. Whitbeck. The treasurer is C. B. Whittelsey.

Membership in the society is now increasing at the rate of 1000 per year. On Jan. 1 the society had a membership of 3866. The financial returns and earnings were greater last year than ever before in spite of the war, and the outlook is excellent for a greatly increased membership and a successful year in every way.

Short but significant discussions are developing as a result of the program laid down for the professional sessions. A symposium on the probable effect of airplane engine design on automobile practice was awaited with interest by the society, this being rendered by H. M. Crane, Howard Marmon and O. E. Hunt. These men, all having had extended experience in the manufacture of airplanes during the war, were in remarkable alignment as regards their opinions.

It is their unanimous opinion that the real influence will be in the introduction of better manufacturing methods in automobile practice due to the education of handling finer materials and through closer limits on a production basis. All are agreed that greater noise and decreased flexibility of the airplane engine make it impossible as a motor car powerplant.

Considerable surprise was expressed by some of the members in regard to the poor economy secured in the British tractor tests where some of the tractors used as much as 8 gal. per acre pulling a four-bottom plow. This was brought out by Edward R. Hewitt in digesting his paper on the "Principles of the Wheeled Farm Tractor." According to Mr. Hewitt's figures the best results secured were 2½ gal. per acre and the average was 5½ gal. Another comment made was on the poor acreage plowed in the English tests. It was cited by one member that in Texas he had been able to average 7 acres per day, plowing 280 acres in 40 days with a three-bottom machine.

President C. F. Kettering pointed out that even with the tractor of admittedly poor construction the farmer cannot afford to dispense with it, as he is able to have his silo full of feed that would otherwise not be there. The season is short in which definite work is to be done on the farm and the ability of the tractor to handle it is one of the best reasons for its success.

Lieut.-Col. H. W. Alden in presenting his paper on "Tanks" gave some interesting sidelights on the real purposes of these fighting machines, telling that the work for which they are most valuable is the elimination of machine gun nests. Moving pictures showing the 40-ton Mark VIII machine in action were given.

C. M. MANLY

Newly elected President of the S. A. E.

Mr. Manly is one of the pioneers of the airplane industry, having been associated with Professor Langley in the latter's historic experiments on mechanical flight during the early part of the present century. He is also the inventor of a hydraulic transmission for motor vehicles and occupies the position of consulting and chief inspection engineer of the Curtiss Aeroplane Corporation.

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Morse Abroad for Willys-Overland

NEW YORK, Feb. 5—Elliot C. Morse, chief of the Willys-Overland Export Co., sailed to-day for England to look into export and import conditions in that country and throughout Europe. He will be away until May 1. Mr. Morse was in charge of Willys-Overland Co. interests in Washington during the war, and has now taken over the supervision of the foreign business of the company.

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$29,940,780 General Motors Surplus

NEW YORK, Feb. 5—The financial statement of the General Motors Corp. and its subsidiary companies, including five months' operation of Chevrolet for the twelve months ending Sept. 30, 1918, shows total assets of the corporation to the amount of $208,252,477. After paying all expenses, taxes, bonds, etc., a surplus of $29,940,780 remains. Gross sales for 1918 amount to $39,254,396 and gross earnings to $10,568,245.

As compared with the year ending Dec. 31, 1917, there is an increase of total assets amounting to $74,462,753, and an increase of gross sales of $4,433,870.

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No Price Reduction for Six Months Is General Feeling

NEW YORK, Feb. 3—Judging from the attitude of the manufacturers of the cars exhibited at the show, it is quite certain that there will be no general reduction in car prices for at least six months. There have been only two or three instances of price drops in the last week. Almost without exception guarantees are being given against reductions. In some cases these guarantees are qualified to the extent that if there is a drop within the period of the guarantee the dealer will receive a refund of the difference in price. Those who are not so bold as to actually guarantee the price "assure" the dealers and the public that cars will not be cheaper.

July 1 seems to be the date generally fixed for the period of the guarantee, a very small minority being for 3, 5, 7 and 8 months.

Automotive Industries

Labor Situation Has Passed Crisis

Detroit Believes Surplus Will Now Gradually Work Off —Not Serious Now

DETROIT, Jan. 29—Manufacturers now believe that the labor situation in Detroit has passed its crisis and from now on the surplus of labor will gradually grow less. Many plants which have been running on skeleton crews are resuming operations on their old time scale. Two of the biggest Detroit companies, the American Car and Foundry Co. and the Lincoln Motors Co., will close down temporarily in a few days, however, releasing 6,000 men, but in spite of this setback, labor officials are optimistic.

That the unemployment situation is at its peak and that there will be no acute suffering unless unforeseen developments occur is the opinion of leading factory officials who met Tuesday, Jan. 28, in conference at the Board of Commerce. Figures presented at this meeting estimate that there are approximately 35,000 men out of work. The temporary closing of the two big plants will send these figures to 41,000, but from then on they will recede.

The situation is not as serious as the figures would indicate. Reports show that savings in the banks of Detroit are not only increasing month by month, but are increasing in a cumulative ratio, showing that money is not being withdrawn for current expenses as it would be in a serious unemployment situation. Another optimistic report from the unemployment standpoint was that one-half of the 5000 employees of the American Car and Foundry Co. are intending to "go back home," having been attracted to Detroit by high wages.

Manufacturers are getting large orders and receiving raw material which will shortly enable them to increase the number of their employees. Delay in the settlement of war contracts by the Government and a belief of business men that prices will come down, a belief which is not justified according to industrial leaders, are the two obstacles to the period of great prosperity. Action on Government contracts is expected shortly, while business men in general are beginning to realize that prices are going to stay up.

Soldiers returning to Detroit are not furnishing as serious a problem as was expected. Figures show that between 13,000 and 15,000 service men have returned to the city. Of these only 2750 have applied for employment at the Government office. Of these over 70 per cent have been placed. Of the thousands who have not applied for employment, the great majority have probably gone back to their old places.

To keep in constant touch with the situation, a combined committee of the Board of Commerce and the Employers' Association and other civic groups will be appointed.

Government to Use All Machines in Service

DETROIT, Feb. 4—Col. Edwin F. George, chief of the motors branch of the Purchase, Storage and Traffic Department of the army, Washington, today said that the Government had completed plans for the utilization of every car, truck and tractor now in service, and that in no event would machines be placed on public sale. Colonel George explained that the War Department will first decide on the number of machines required for the permanent army organization. The remaining trucks will be turned over to the Post Office Department, the Department of the Interior and other Government departments. What trucks then remain will be placed at the disposal of each State for agricultural, National Guard and other purposes.

Sale of Supplies Overseas Authorized

WASHINGTON, Feb. 4—An order issued to-day by General Peyton C. March authorizes the commanding generals of the American Expeditionary Forces to sell any war supplies, including motor trucks, passenger automobiles and motorcycles, to concerns, individuals or nations that were allied with the United States. These are to be sold by auction or by sealed bids when no longer needed for the Army. Reports of sales are to be made monthly. No materials or supplies are to be sold for less than their invoice price, including cost of inspection and transportation. Some restrictions in sales are made on guns and railways and immovable property.

Commerce Motor Car Official Dead

DETROIT, Feb. 4—George J. Kellogg, for eight years secretary and treasurer of the Commerce Motor Car Co., died Sunday at Grace Hospital, following an operation. He was an official of the Commerce company from its incorporation.

82,436 Overlands in 1918

TOLEDO, Feb. 4—The Willys-Overland Co. turned out 82,436 cars in 1918, as compared with 140,002 the year before. In addition, the company completed 42 per cent of its war orders, totaling $80,000,000.

Validating Bill Is Passed

Senate Approves Measure to Relieve Contractors— Several Amendments

WASHINGTON, Jan. 31—The bill to provide for payment of informal contracts has been passed by the Senate. It will now go to conference and then probably be reported to the House.

The bill passed is the one drawn up by the War Industries Board and advocated by the United States Chamber of Commerce, the Motor & Accessories Manufacturers' Association and other industries, although the bill as originally approved by these bodies did not contain the numerous amendments that have since been added.

The act authorizes the Secretary of War to waive non-compliance with the law in the matter of the irregularly made contracts. It creates a commission composed of three members, representing the War Department, Department of Justice and a third the business interests of the country. Concerns or individuals who are dissatisfied with the decision of the Secretary of War can appeal to the commission.

A provision authorizes the Secretary of War to secure satisfactory evidence that subcontractors will be properly paid before making payments to prime contractors. Reports of all operations under this act must be filed with Congress before the first Monday in December of each year. Following is the complete bill:

(*Continued on page* 339)

Additional Aero Banquet Guests

NEW YORK, Feb. 5—Coming with Lieutenant Fonck as representatives of the French Government at the Aero banquet on Feb. 19 are Sub-Lt. Charles Nungesser and M. Esnault Peltrio, one of the foremost French engineers and president of the Airplane Manufacturers and Industries in France. He will discuss the development and possibilities of the airplane for commercial uses.

Westcott Has a Lighter Six

SPRINGFIELD, OHIO, Feb. 2—The Westcott Motor Car Co. is working on a new model, a lighter six, and it is hoped that it will be ready in time for the Atlantic City Show the latter part of this month. The new car does not differ radically from the heavier six, which is now going through, but is more or less a small edition of it. No price has as yet been set, and it is not expected that this detail will be made public till the car gets

into production. The salient features include a Continental 3¼ x 4½-in. six-cylinder engine, automatic thermostatic water regulation, Fedders radiator, Delco ignition, Borg & Beck clutch, Brown-Lipe gearset, Hotchkiss drive, Timken axles and a Stewart vacuum fuel feed system. Grease cups have been entirely eliminated from the car, and every part requiring lubrication is supplied with oil fed by wicks. The tire equipment is 33 x 4 both front and rear, and the standard finish on the body and wheels is green.

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Freight Rates to United Kingdom

WASHINGTON, Jan. 30—The United States Shipping Board has made public to-day the following rates of freight from the United States North Atlantic ports to Liverpool, London, Manchester, Hull, Avonmouth, Bristol, Cardiff, Glasgow, Leith and Belfast on a list of commodities which included:

Agricultural tractors $1 per 100 lbs. or 50 cents per cu. ft.

Auto trucks, $1 per 100 lbs. or 50 cents per cu. ft.

Ball bearings, $1 per 100 lbs.

Gas engines as parts of agricultural tractors or not as parts of agricultural tractors, $1 per 100 lbs. or 50 cents per cu. ft.

Other automotive products or materials not enumerated take a rate of $1 per 100 lbs. or 50 cents per cu. ft., ship's option.

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Simplify Import List

WASHINGTON, Jan. 30—Individual import licenses will no longer be required for the importation into the United States from the United Kingdom, France, Italy, and Belgium and their European and Mediterranean African possessions and protectorates of any automotive commodities except the following: Naxos emery, naxos emery ore, ferro-manganese, spiegeleisen, nitrates, tin, tin ore and tin concentrates, or metals containing over 5 per cent tin.

It was also announced by the Board that all commodities imported into Alaska, Guam, Hawaii, Tutila, Porto Rico, the Virgin Islands, the Canal Zone, and the Philippine Islands may now be transshipped to destinations other than the United States.

All such relaxation of import restrictions, it was stated, will expedite import shipments and will tend to restore the entire import trade to normal conditions.

Thompson Elected Head of M. A. M. A.

President of Steel Products Succeeds Stiger—Broadwell First Vice-President

CHICAGO, Feb. 3—Charles E. Thompson, president of the Steel Products Co., Cleveland, was elected president of the Motor and Accessory Manufacturers' Association at a meeting of the Board of Directors Thursday afternoon, Jan. 30. He succeeds C. W. Stiger, Chicago, president of the Stromberg Motor Devices Co. The directors chosen were: E. P. Hammond, president of the Gemmer Mfg. Co., St. Louis, and G. W. Yeoman of the Continental Motors Co., Detroit. Other officers elected included: first vice-president, E. A. Broadwell, vice-president Fisk Rubber Co.; second vice-president, Christian Girl, president Standard Parts Co.; third vice-president, W. O. Rutherford, vice-president B. F. Goodrich Co.; treasurer, L. M. Wainwright, president Diamond Chain Co; secretary and assistant treasurer, T. J. Wetzel, Precision Castings Co.; manager, L. M. Bradley, and assistant manager, L. M. Heminway.

The afternoon meeting was a business session at which the retiring president delivered an address.

The evening session constituted chiefly the banquet in the gold room of the Congress Hotel and was attended by about 400 members.

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Lieut. Fonck to Represent France at Aero Banquet

NEW YORK, Feb. 1—It is understood that Lieut. René Fonck, the leading French ace, who is also the premier ace of the world, will represent France at the Aero Club of America banquet on Feb. 19. At the request of the Foreign Service Committee of the club, he has been granted permission by the French Government to represent it, and is preparing to come to the United States at once.

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$1,096,114,908 Spent for Air Service

WASHINGTON, Feb. 1—Total disbursements by the Bureau of Aircraft Production and the Division of Military Aeronautics amounted to $691,503,165 to Dec. 1, 1918, and outstanding obligations incurred to that date and not paid were $404,611,742, according to a statement of military appropriations filed with Congress yesterday. These expenditures allow a remaining $463,532,925 as the balance of appropriations not required.

According to the same report the Ordnance Department disbursed $25,771,912.91 for armored motor cars to Dec. 1, 1918, with outstanding obligations for the same product totaling $79,584,252.82. Appropriations of $406,640,000 allowed for armored motor cars by the acts of July 9 and Nov. 4, 1918, were untouched.

Below is the statement of the Division of Military Aeronautics and the Bureau of Aircraft Production.

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Detroit-Pittsburgh Airplane Express Route Advocated

DETROIT, Jan. 31—Automobile and other automotive industrial companies are asked to guarantee sufficient business to permit the establishment of an airplane express route between Detroit and Pittsburgh this spring. The Detroit and Pittsburgh Boards of Commerce have endorsed a plan submitted by Lieutenant B. Vernon, Flying Field, Philadelphia, for the immediate establishment of such a line, providing sufficient business can be secured. Lieutenant Vernon proposes to operate two planes, one to fly from Detroit to Pittsburgh and the other from Pittsburgh to Detroit, stopping at all intermediate cities. Discounting time required to make principal stops, a machine leaving Detroit at 10.30 a. m. will reach Pittsburgh at 3.30 p. m.

The proposed air express company will carry express for $1.78 a pound, subject to a 40 per cent discount if a satisfactory amount is sent at one time.

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Le Pere Planes at Bolling Field

WASHINGTON, Jan. 30—Two of the latest type American-made scout planes, the Le Pere, have arrived at Bolling Field for test flights. These are the first two planes of this particular model made in the United States and were designed for use of American aviators at the front. It was stated at Bolling Field last night that these planes are equipped with the latest mechanical devices, having a balanced elevator and great speed.

The airplanes are camouflaged green, blue and white, and have 12-cylinder Liberty engines. The planes, it was stated, weigh approximately 3500 lbs., with a wing spread of 24 ft. They can climb 22,000 ft. and attain a speed rate of 135 m. p. h.

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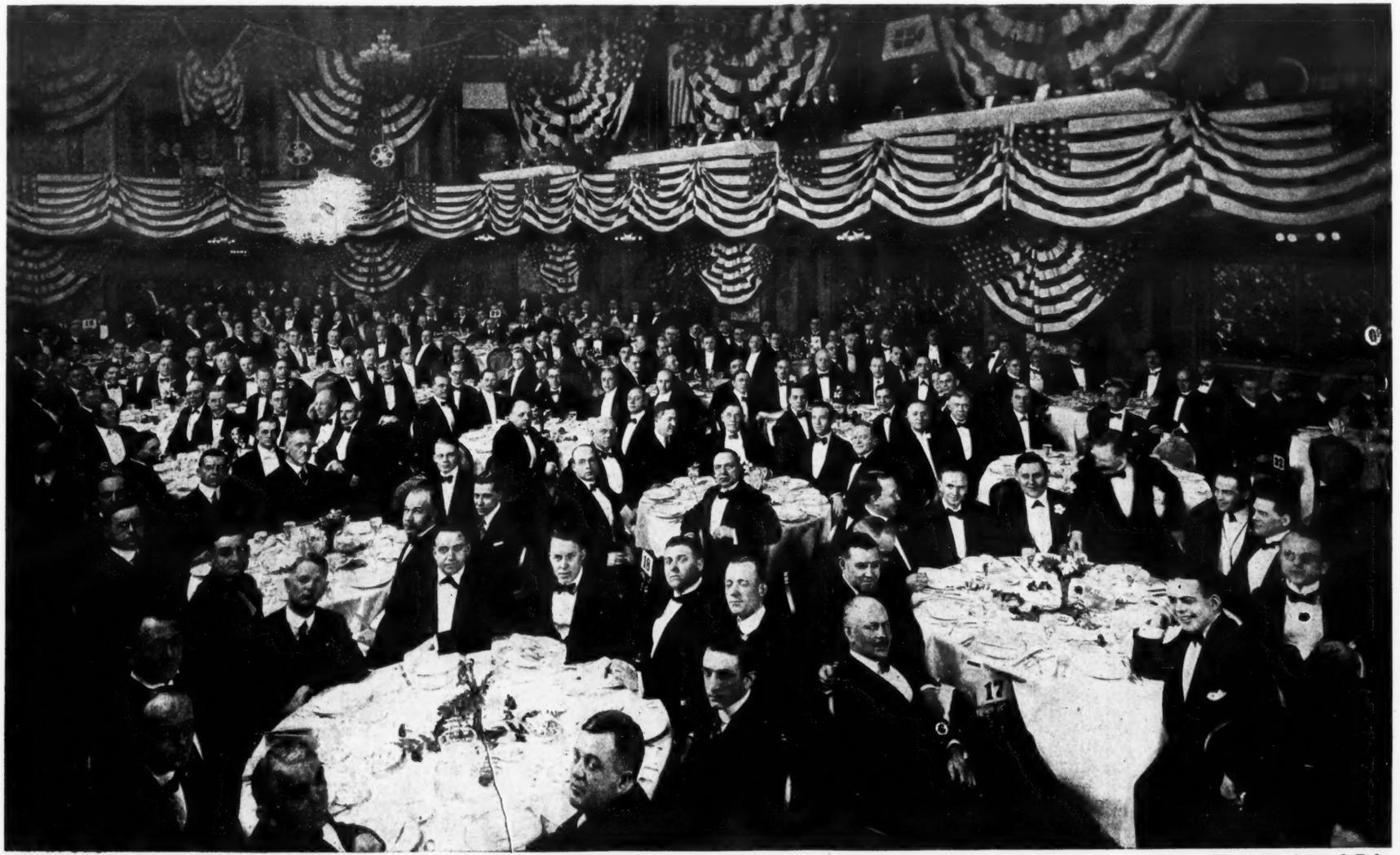
Hawkins Reported in Combine

NEW YORK, Feb. 6—A great consolidation of passenger car, truck, tractor and parts makers to be headed by Norval A. Hawkins, former sales manager of the Ford Motor Co., will shortly be completed, according to persistent reports. New York financiers are said to be behind the deal which it is understood is practically completed now.

DIVISION OF MILITARY AERONAUTICS					
Air Service, military, acts July 9, Nov. 4, 1918	$184,304,758.00	$53,254,806.40	$46,050,000.00	$23,467,026.42	$61,532,925.18
Aviation stations, seacoast defense, act July 8, 1918	8,000,000.00	.....	.....	8,000,000.00	.....
Totals	$192,304,758.00	$53,254,806.40	$46,050,000.00	$31,467,026.42	$61,532,925.18
BUREAU OF AIRCRAFT PRODUCTION					
Air Service (Production), act July 9, 1918	$760,000,000.00	$34,490,492.11	$225,251,843.63	$100,257,664.26	$400,000,000.00
Increase for Aviation Signal Corps, act July 24, 1917	640,000,000.00	522,161,120.38	117,838,879.62	.....	.....
Signal Service of the Army, acts May 12, June 15, Oct. 6, 1917	99,067,766.00	81,596,746.98	15,471,019.02	.....	2,000,000.00
Totals	$1,499,067,766.00	$638,248,359.47	$358,561,742.27	$100,257,664.26	$402,000,000.00

Annual Banquet of the M. A. M. A. During the Chicago Show



—Photo Kaufman & Fabry

More than 400 members of the Motor and Accessory Manufacturers' Association and guests attended the annual banquet of the association held during the Chicago show

Big Drop in Automotive Exports for Calendar Year 1918

Figures Maintained for Fiscal Year Ending June 30, but a Net Loss of Over $15,000,000 Incurred in Last Six Months

	Cars	Value	Trucks	Value	Parts
Totals by Months, 1918					
December	1,703	$2,203,027	896	$2,636,689	$2,191,511
November	2,226	2,576,622	974	2,709,362	2,166,719
1917					
December	6,442	$5,380,702	807	$1,592,881	$4,952,615
Totals by Calendar Years					
1918	36,936	$36,278,292	10,308	$26,814,952	$33,607,050
1917	65,576	51,872,905	14,479	36,755,236	31,624,963
Loss or gain in 1918	—28,820	—$15,594,613	—4,171	—$9,940,284	+$1,982,087

WASHINGTON, Jan. 31—When considering the matter of exports it is advisable to remember that the Government fiscal year ends on June 30 in each year and that for this reason it frequently happens that misunderstandings arise in connection with figures covering the Government year and those relating to the calendar year.

In the table herewith the totals are those of the calendar year, the figures for the fiscal year 1918 having been published in AUTOMOTIVE INDUSTRIES of Aug. 8. A comparison of these two sets of figures is of interest, especially at this time of reconstruction and consequent partial derangement of manufacturing programs.

Turning to the totals covering the fiscal year ending June 30, 1918, and segregating those referring to cars, trucks and parts, it is found that our total exports for the Government year were valued at $110,106,505 for 1918 and $118,377,047 for 1917, showing a drop in 1918 of $8,270,542.

Taking calendar year totals on similar items, as shown in table herewith, the values are $96,700,294 for 1918 and $120,253,104 for 1917, an apparent gross falling off of $23,552,810, or, deducting the fiscal year drop, a net loss of $15,282,268 on the year ending Dec. 31, 1918.

However, this is hardly an accurate way of determining the position, for it assumes that our export figures ran 50-50 during the first six months of 1918, a period common to both methods of computing the year's totals. It is quite conceivable that the loss occurred during the last six months of 1917, a period included in the 1918 fiscal year. At the same time there are regrettable indica-

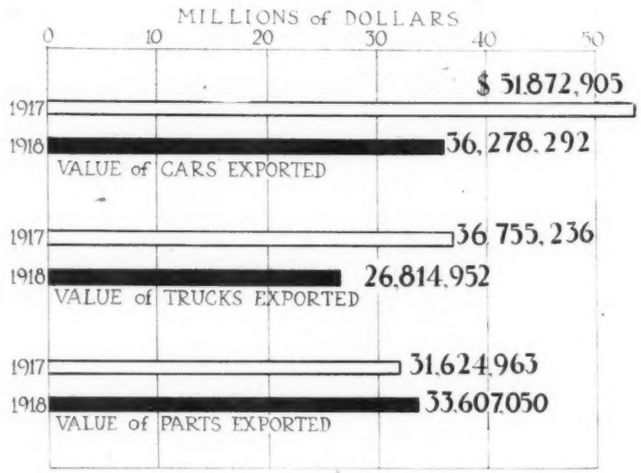


Chart illustrating the drop in exports of cars and trucks and the slight gain in parts as between the calendar years 1917 *and* 1918

Exports of Automotive Equipment for Twelve Months Ending December, 1918

	Month of December				Twelve Months Ending December			
	1918		1917		1918		1917	
	No.	Value	No.	Value	No.	Value	No.	Value
Airplanes	.....	.....	1	$17,250	48	$607,255	140	$1,100,207
Airplane parts	.....	$424,784	.....	870,924	.....	14,670,269	.....	5,505,565
Commercial cars	896	2,636,689	807	1,592,881	10,308	26,814,952	14,479	36,755,236
Motorcycles	481	114,405	1,284	293,325	9,212	2,169,385	14,320	3,035,032
Passenger cars	1,703	2,203,027	6,442	5,380,702	36,936	36,278,292	65,756	51,872,905
Parts, not including engines and tires	.....	2,191,511	.....	4,952,615	.....	33,607,050	.....	31,624,963
Total (trucks, cars and parts value only)	.....	$7,031,227	.....	$11,925,698	.....	$96,700,294	.....	$120,253,104
ENGINES								
	No.	Value	No.	Value	No.	Value	No.	Value
Automobile, gas	1,777	$332,112	7,667	$943,196	30,813	$4,188,675	36,768	$4,223,095
Marine, gas	499	250,127	921	511,426	5,483	2,790,833	10,334	2,427,058
Stationary, gas	1,222	219,670	3,856	398,292	26,608	3,332,131	27,610	3,237,647
Tractor, gas	1,734	1,355,338	1,226	1,482,746	23,424	24,402,949	14,031	16,521,444
Total value	.....	$2,157,247	.....	$3,335,660	.....	$34,714,588	.....	$26,409,244

	EXPORTS BY COUNTRIES DECEMBER, 1918				TWELVE MONTHS ENDING DECEMBER, 1918			
	Passenger Cars		Trucks		Passenger Cars		Trucks	
	No.	Value	No.	Value	No.	Value	No.	Value
Argentina	163	$152,698	2	$844	1,628	$1,673,137	45	$40,707
Australia	254	239,375	.....	.....	3,826	3,271,317	.....	.....
British India	8	11,420	.....	.....	72	70,254	.....	.....
British South Africa	129	136,909	.....	.....	1,205	1,070,570	.....	.....
Canada	55	75,588	97	143,329	8,542	7,140,776	1,596	2,035,464
Chile	129	263,788	.....	.....	1,734	2,315,386	.....	.....
Cuba	121	208,797	50	87,382	1,909	2,638,001	557	1,109,368
Denmark	27	48,643	.....	.....	98	159,516	.....	.....
Dutch East Indies	194	273,863	.....	.....	1,260	1,567,760	.....	.....
France	4	15,890	370	1,706,184	1,003	1,134,818	3,356	12,920,029
Mexico	87	108,637	.....	.....	1,916	1,538,893	.....	.....
New Zealand	63	71,878	.....	.....	1,418	1,228,864	.....	.....
Norway	.....	.....	.....	.....	198	430,514	.....	.....
Philippine Islands	50	46,031	.....	.....	1,690	1,462,571	.....	.....
Russia in Asia	.....	.....	.....	.....	3	11,734	15	18,200
Russia in Europe	.....	.....	.....	.....	10	8,325	2	5,454
Spain	47	67,946	.....	.....	808	1,042,789	.....	.....
United Kingdom	1	1,000	10	19,361	423	1,082,347	2,264	6,671,230
Uruguay	.....	.....	.....	.....	1,351	799,787	.....	.....
Other Countries	371	480,564	367	679,589	7,842	7,630,927	2,473	4,014,500
Totals	1,703	$2,203,027	896	$2,636,689	36,936	$36,278,292	10,308	$26,814,952

tions that our export trade in cars and trucks has been on the down-grade for some months.

This apparent fact should not be accepted as an indication that our export business is leaving us permanently. It is rather a sign that circumstances and conditions quite outside of the automotive industry are not propitious for the time being. We are handicapped in our foreign trade at the present time by the state of national unrest existing in practically every country in the world, we find it hard to sell cars and trucks to countries which have no gasoline and but few available tires, and our difficulties do not end here.

The process of reconstruction on an improved ante-war basis is the big subject which is occupying the majority of our best customer countries to-day, and until commercial relations can assume a condition more nearly approaching normal it is too much to expect that our automotive export business will start in breaking records, as in 1916-17 and the earlier part of 1918.

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Decrease in Canadian Motor Imports and Exports

WASHINGTON, Feb. 3—During the year 1917 there were in Canada eleven automobile manufacturers, twenty automobile accessory manufacturers and 497 repairshops, according to a report made by the United States Consul General at Ottawa. The capital invested in these industries was divided as follows: $28,192,858 in automobile manufacture, $3,155,893 in accessory manufacture and $4,431,926 in repairshops, making a total investment of $35,780,677.

Materials to the value of $35,585,820 were used in the manufacture of automobiles, $3,788,308 in accessories and $1,961,773 in repairs. The value of automobiles produced was $54,466,273, of accessories $6,495,868 and of repairs $5,091,066, making a total for the year of $66,053,207. The number of different types of cars produced, classified according to purposes, were: Touring cars, 80,544; runabouts, 5502; closed cars, 1231; club roadsters, 561; trucks, 117, and unclassified, 1721, or a total of 89,676.

The number of automobiles exported during the 12 months ended October, 1918, was 8044, valued at $3,692,524, against 9349, valued at $4,504,772 during the preceding 12 months. The value of automobile parts exported during the same periods was $1,202,055 and $1,523,678 respectively. Imports of motor cars during the six months ended September, 1918, amounted to 5689, valued at $5,018,941, and parts to $3,511,077, compared with 11,171 automobiles, valued at $7,870,377, and parts at $3,698,140, imported during the six months ended September, 1917.

The following table shows the number of employees on a wage basis in each class and the amount paid them:

Industry	Males	Females	Wages
Automobile plants..	4852	164	$4,862,779
Accessory plants...	1405	122	1,198,596
Repairshops	1508	34	1,200,958
Totals.....	7765	320	$7,262,333

December Exports from New York

Parts Show Gain for Month, but Exports of Both Cars and Trucks Have Dropped

NEW YORK, Jan. 31—Exports of cars, trucks and parts from this port for December, 1918, represented in value approximately 50 per cent of the total car, truck and parts exported from all United States ports during that month. This proportion is rather under the mark, as New York is usually credited with around 60 per cent of the country's exports.

The increases shown in car and truck export figures for November were not maintained during December, the former dropping in number from 806 to 740, but showing a slight gain in value, the figures being $1,003,416 and $1,020,126 respectively. Four hundred and thirty trucks, valued at $1,564,293, were exported in December, as against 549, valued at $1,733,489 in November. On the other hand, parts have shown a gain, the December figures being $898,513, as compared with November's $593,414.

December's list of buying countries is somewhat restricted, as compared with those of the previous month, no shipments having been made to over a dozen which figured in the November table. When considering exports from New York to such places as Australia, New Zealand, Japan, etc., it should be noted that many shipments are made to these and other Oriental countries from Pacific ports. For example, Australia shipped 140 passenger cars from New York during December, but she also shipped 114 from other United States ports.

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To Relax Export and Import Restrictions

WASHINGTON, Feb. 3—Further relaxation of restrictions and simplified procedure will be made shortly by the War Trade Board for the benefit of American exporters and importers. The method by which exporters were forced to procure individual export licenses during the war will be abolished as quickly as possible and a general license permitting the export of specified commodities to specified destinations will be issued instead wherever possible. This policy will be specifically applied to export shipments to the United Kingdom, France, Italy or Japan and their colonies, possessions and protectorates, Belgium and the Belgian Congo, Canada and Newfoundland.

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New and Simplified Import License

WASHINGTON, Jan. 25—A new general import license, to be known as PBF No. 31, has been issued by the War Trade Board to cover all shipments of unrestricted commodities in transit through the United States where shipment from abroad is made after Jan. 21, 1919. This license does not relieve shipments of commodities in transit of the necessity of complying with whatever regulations are in operation and cover such shipments at the time.

AUTOMOBILE, TRUCK AND PARTS EXPORTS FROM NEW YORK FOR DECEMBER

	Cars		Trucks		Parts
	No.	Value	No.	Value	Value
Argentina	42	$32,885	2	$844	$257,051
Australia	140	134,489	..	.....	28,157
Barbadoes	..	.....	1	2,792	2,779
Bolivia	1	2,320	8	24,516	1,711
Brazil	14	14,460	..	.....	991
British Guiana	3	3,170	..	.....	2,318
British India	7	9,920	1	2,118	29,051
British South Africa	100	108,416	1	2,279	27,701
British West Africa	12	10,169	2	3,037	9,111
British West Indies	3	1,967	..	.....	2,754
Canary Islands	..	.....	..	.....	600
Chile	112	245,900	23	26,158	67,030
Costa Rica	..	.....	..	.....	1,024
Cuba	22	54,097	25	32,274	55,063
Danish West Indies	1	1,741	..	.....	650
Denmark	27	48,643	..	.....	811
Dutch East Indies	46	41,317	20	42,785	36,784
Dutch Guiana	..	.....	..	.....	376
Dutch West Indies	..	.....	..	.....	243
Ecuador	..	.....	..	.....	520
England	1	1,000	10	19,361	135,174
France	4	15,890	295	1,330,690	126,503
French Africa	22	8,611	1	1,912	15,485
French West Indies	4	4,900	..	.....	3,088
Guatemala	..	.....	..	.....	886
Haiti	9	8,588	..	.....	848
Honduras	..	.....	..	.....	228
Hongkong	4	2,800	..	.....	360
Iceland	4	3,779	..	.....	.....
Jamaica	..	.....	..	.....	10,460
Japan	1	1,600	5	6,436	236
Mexico	15	24,150	5	4,176	7,314
Newfoundland	18	25,407	4	1,998	256
New Zealand	..	.....	1	2,296	4,844
Nicaragua	..	.....	..	.....	490
Norway	..	.....	5	16,800	2,533
Panama	2	2,500	..	.....	3,300
Peru	57	105,673	14	35,816	9,779
Portuguese Africa	..	.....	..	.....	381
Russia in Europe	..	.....	..	.....	127
Salvador	6	9,000	..	.....	1,041
Santo Domingo	9	7,393	..	.....	14,122
Siam	..	.....	..	.....	1,053
Spain	45	63,118	2	1,805	7,947
Straits Settlements	..	.....	4	6,200	18,178
Trinidad	..	.....	..	.....	2,505
Venezuela	10	13,223	..	.....	6,445
Totals	740	$1,020,126	430	$1,564,293	$898,513

More Than 400 Gather at S.A.E. Home-Coming Supper

CHICAGO, Jan. 30—Four hundred representatives of the various automotive industries outlined their activities for the reconstruction period in connection with the home-coming supper and afternoon technical session of the Society of Automotive Engineers at the Hotel Morrison to-day. While most engineers realize the pace throughout the automotive world will be much faster in the coming years, there is a feeling of optimism that whatever conditions prevail the engineers of the country will shape the destinies of their respective industries in the same satisfactory manner as was done throughout the war period. President Kettering stated that as a result of war work we have on hand a tremendous amount of technical information, all or some of which will undoubtedly be used by engineers and designers in the motor car, truck, tractor and airplane field.

Besides President Kettering, the speakers of the evening included George W. Smith, assistant chief engineer Nash Motors Co. and chairman of the Midwest Section, S. A. E.; H. H. Merrick, president Chicago Association of Commerce; Col. Chauncey Baker, Quartermaster Department, Motor Transport Section; William B. Stout, United Aircraft Engineering Corps, New York. E. E. Peake, executive secretary National Automobile Dealers' Association, acted as toastmaster. The afternoon session was given entirely to reading and discussion of technical papers, the severity of which, however, was relieved by Capt. Mark Smith, U. S. M. C., who told of his experiences at Chateau-Thierry.

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Stewart-Warner Earns $1,504,664

CHICAGO, Feb. 5—The Stewart-Warner Speedometer Corp. showed net profits for the year ending Dec. 31, 1918, of $1,594,664 after Federal income, excess profits and war profits taxes were deducted. As compared with $1,860,774 for 1917, this is a loss of $365,110. After dividends were paid, a surplus of $994,664 remained, as compared with $1,260,774 for 1917. Net profits for 1918 are equal to 15.94 per cent on capital stock, which was recently raised from a 6 to an 8 per cent per annum basis.

The comparative statement for 1918 and 1917 follows:

	1918	1917
Profit and income, after deducting expenses, depreciation, etc.	$2 002,646	$2,234,824
Provision for taxes	407,982	374,050
Net profit	$1,594,664	$1,860,774
Dividends	600,000	600,000
Surplus	994,664	$1,260,774
Previous Surplus	5,456,216	4,195,442
Total Surplus	$6,450,880	$5,456,216

—

Indict 13 Pan-Officers

CHICAGO, Feb. 1—Indictments against thirteen officers and directors of the Pan Motor Co., St. Cloud, were returned to-day by the Federal Court, charging the use of mails to defraud. The indictment alleges a stock-promoting scheme.

The concern is incorporated under the laws of Delaware and the men indicted are: Samuel C. Pandolfo, St. Cloud, president; Norman A. Street, promoter, Chicago; George Heitman, Chicago; H. S. Wigle, Spokane, Wash.; John Barritt, St. Cloud; Charles D. Schwab, St. Cloud; Fred Shilpin, St. Cloud; Charles Bunnell, St. Cloud; George E. Hanson, St. Cloud; Charles F. Ladner, St. Cloud; Peter R. Thielman, St. Cloud; Hugh Evans, St. Cloud, and H. C. Erwing, Jr., St. Cloud.

The indictment charges that approximately $5 500,000, including $250,000 in Liberty Bonds, was accepted from 50,000 working people throughout the country.

A recent financial statement issued by the company, the indictment asserts, claims that the company had a surplus of $2,500,000, although it never was on a production basis. The surplus, it is charged, was created by capitalizing intangible assets.

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National Show Managers' Association Re-elects Officers

CHICAGO, Feb. 4—At the annual meeting of the National Association of Automobile Show Managers last week all the officers of the organization were re-elected, as follows: President, E. E. Peake, Kansas City; vice-president, Bart J. Ruddle, Milwaukee; secretary-treasurer, Ray W. Sherman, Motor World, New York.

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No Automobiles for Sale by Army

WASHINGTON, Feb. 4—Further official denial of the rumors that the army is selling passenger automobiles was made here to-day by the War Department. A public statement given to the press denies that dealers or others have purchased any cars from the army, and adds that second-hand dealers who advertise that they have cars for sale purchased from the government are not telling the truth. Following is the announcement:

"There are persistent rumors all over the country to the effect that the War Department is disposing of a large number of automobiles by auction or private sale at reduced prices and in many cases to brokers. At the present time there are available no passenger automobiles for sale. New cars will be turned back through the original manufacturer in every case where practicable.

"It has been noted that a number of second-hand dealers have advertised from time to time quantities of new or nearly new material which they claim to have purchased from the War Department. These cases have been investigated, and in every instance so far, material advertised has not been property of the dealer and the Government had no intention of selling him this property. In this connection it should be distinctly understood that it is not the policy of the War Department to sell property to anyone for speculative purposes."

—

Jordan Prices Drop

CLEVELAND, Feb. 3—The Jordan Motor Car Co. has reduced the price of five of the company's six models as follows:

Model	New Price	Old Price
Touring car	$2,475	$2,775
Four-passenger sport model	2,475	2,775
Sedan	3,500	3,750
Four-passenger brougham	3,500	3,750
Town car	3,500	3,750
Limousine	3,750	3,750

Rickenbacker, American Ace, Honored at Banquet

NEW YORK CITY, Feb. 4—Captain E. V. Rickenbacker, America's ace of aces, shared plaudits with his mother last night when the nation officially welcomed the former racing driver at a banquet given in his honor by the Contest Board of the American Automobile Association and allied motoring and aviation organizations at the Waldorf-Astoria. Seven hundred of the big men in motoring and aviation gathered to do honor to the man who had brought down twenty-six Huns. Secretary of War Baker, Chief, Bureau Aircraft Production, Major-General Menoher, Congressman Ireland, ex-Congressman Bourke Cochrane and others voiced the welcome of the victorious flyer's admirers. Cablegrams were read from General Pershing and others who had known Rick in service and on the speedways. Through Rick his friends presented his mother with a pair of platinum wings set with diamonds and sapphires in honor of her eagle son.

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Studebaker Branch Management Changes

NEW YORK, Feb. 3—F. R. Bump, who has been manager of the Studebaker branch for many years, has resigned, and Ira C. Jones has taken up his duties. Mr. Jones was formerly the owner and proprietor of a wholesale jewelry business in New York. He has brought F. L. Sholes into the organization to be retail manager, and F. W. Beinecke, who will be in charge of service. Mr. Sholes was formerly the factory sales manager of the specialty department of the American Can Co. and Mr. Beinecke was in charge of the rolling stock of the Texas company.

—

More Ford Tractor Plants

DETROIT, Feb. 3—The Ford Motor Car Co. is planning a period of expansion The completion of the $7,000,000 tractor factory here is followed by the statement of Mr. Ford that he is preparing to build a tractor factory on the Hudson River, another in Ontario and another plant will be built and transported bodily to Mexico.

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Bethlehem Motors Building Tractors

ALLENTOWN, PA., Feb. 3—The Bethlehem Motors Co. is now building a tractor in addition to its line of trucks. It is hoped to have an exhibition model ready in time to be at the Kansas City Tractor Show.

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New Overland Price Is "Mystery"

DETROIT, Feb. 3—The price of the new light Overland four to be placed on the market May 1 by the Willys-Overland Co., Toledo, has become one of the main topics of discussion in automotive circles. Since the chassis was introduced at the January show last year the trade has been waiting for the new machine and a price announcement. From the Toledo factory comes word that the price will not be made public until the cars are in the hands of the distributers.

Rick's Record Is 100% Perfect

No Damaged Planes Despite 26 Victories—69 Planes to Credit of Squadron 94

NEW YORK, Feb. 1—Eddie Rickenbacker, former racing star, returned on the Adriatic as Captain Rickenbacker, American ace, with 26 Hun planes to his credit in the short period of 7 months that he was on the American front in France. He comes home with more planes than any other aviator in the American service, his closest rival being the late Raoul Lufberry, shot down in France some months ago, who had 18 to his credit. Captain Rickenbacker left his squadron, the Ninety-fourth, of which he was commander, the day after Christmas, and is proceeding to Washington on military orders. His was the leading American squadron, with 69 Hun planes as its share. It is not known whether he will remain permanently in this country or not.

His squadron, whose work began at Chateau-Thierry in July and continued until the armistice Nov. 11, was selected to accompany the army of occupation to Coblenz, a coveted honor for any squadron.

Captain Rickenbacker, or Eddie or Rick, as we still prefer to call him, had a truly meteoric career in the war. He was ordered to the front as an aviator on April 14, 1918, and got his first Hun on April 29. It was from that date up to November that he won the highest honor that could come to an American aviator. He chalked up more victories than any of our flyers in the Lafayette squadron, which had over three years' experience in France. He proved himself as fearless a fighter against the Boche as he was a racing driver on our speedways. In flying, however, he was more fortunate. He had machines, a Nieuport and a Spad, that he could not break up. In his old racing days on Indianapolis and other speedways he ran the wheels off his cars, burned out bearings and put himself out of the winning. In aviation his record has been 100 per cent perfect. He has never crashed a single machine. In training he never once broke up a plane, nor even a wing or a tail.

He brought down 18 Boche planes on his Spad fighter and never crashed or broke his machine. He never had to have a new rudder or elevator put on. Even the 220-hp. Hispano-Suiza engine lasted him for 120 hours, although the average life of these engines in fighting service was 9 hours.

Once Rick was caught in a dog fight. That is what the show was called when eight or ten Boches attacked three or four Allied planes. Rick had been out nearly the limit of the two hours and fifteen minutes for which his Nieuport carried gasoline supply when the dog fight started. He finished the scrap, getting one Hun, and then made for across the front line trenches and home. Before he reached the lines his engine oil was exhausted, the bearings seized, and he was just able to glide across No Man's Land and make a forced landing between rows of barbed wire in an open field. But his pilotship was so expert that even here he did not crash his machine. He tore the tail skid off, but did not crush the landing gear. It was necessary to take the wings off before the plane could be removed to the squadron.

Rick is accompanied by two aces from his squadron. One is Major Meissner of Brooklyn, with 8 victories to his credit, and the other is Capt. Douglas Campbell of Mount Hamilton, Col., who brought down 7 Boches. Both are reporting to aviation headquarters at Washington with Captain Rickenbacker.

Rick left him famous Ninety-fourth at Coblenz in charge of Reed Chambers, who, before going to the war, was the Cadillac agent at Memphis. He is now Captain Chambers, with 7 victories on the official record.

Some of Rick's other fighting "94's" had previous connections with the motor industry, and some were boys fresh from college. Samuel Kayes, with four Boche victims, was the Ford agent at Columbus, Miss. He is still with the squadron at Coblenz.

Wierd Cook, Anderson, Ind., was one of the college graduates, a mere lad from school. Yet he had 6 victories when Nov. 11 ended the show.

Joe Dawson, Denver, Col., no relation to the old race driver, was another fighting member of the 94th, and got 6 Boches.

The squadron, although officially made up of twenty-five planes, was in service with twenty-four and about twenty pilots. They all flew Spads, type XIII, fitted with Hispano-Suiza engines. The Spad is France's best single-seater scout fighter, and has a flying speed of 135 m.p.h., with a driving speed as high as 300 m.p.h. All American fighting scouts used the Spad the last few months. Previous to that many of them used Nieuport Scouts, also French machines, with a rotary air-cooled engine. These were not so recent a creation as the Spad.

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NEW YORK, Feb. 3—Captain Eddie Rickenbacker, America's Ace of Aces, and former racing driver, if he does not change his mind, is out of motor racing for good. While his future is quite unsettled, and he is only home on official orders to report to headquarters in Washington, he has a strong desire to spend the remainder of his days in aircraft service. Indications that his service to his country will not be concluded with his return to America are apparent in the announcement by Director of Publicity Wilson of the Liberty Loan Bureau of the Treasury Department, that for the next month Rickenbacker will pilot a plane doing stunts in Ohio cities to promote the Fifth Liberty Loan.

His ambitions are not to remain a pilot, but may follow either of two directions: First, to continue with the army or Government in aircraft work, or, second, to go into the commercial end, either in engineering or other work.

Michigan and Ohio Car Production

63,246 Passenger Cars Built in January, With Factories Running Below Normal

DETROIT, Jan. 31—Production figures given out by the leading automobile companies of Michigan and Ohio show that approximately 63,246 passenger cars were made during January, notwithstanding the fact that a majority of the concerns were running below normal production and some were not in production at all. The figures are fairly accurate and show that the delay attendant on reconstruction work will very likely curtail the 1919 car output 33 1/3 per cent.

Had normal conditions prevailed, the number of cars made in this district in 1919 would have exceeded the 3,000,000 mark, and may even have a total of 3,500,000, automobile manufacturers contend Delay in contract settlement and in shifting the big plants from a war to a peacetime basis will cut the estimated production to approximately 2,000,000 machines, unless the trade demands necessitate the adoption of an over-time schedule by the larger plants.

Thirty-two manufacturers submitted production figures. Oldsmobile and Chevrolet figures were not available. The Packard, White, Jackson and King companies are not in production. The King people will start making cars this month. The White and Jackson companies may both produce a passenger car this year.

Ford production is now 1300 cars a day, which is more than half below normal. This company will be hitting the 3000 mark by the middle of March. The production tabulation follows:

Car	Daily Production
Buick	100
Briscoe	30
Cadillac	55
Chalmers	30
Chevrolet	
Columbia	8
Dodge	300
Dort	40
Ford	1300
Harroun	4
Hudson	30
Essex	38
Hupp	10
King	0
Liberty	15
Maxwell	150
Oakland	160
Oldsmobile	
Overland	320
Packard	0
Paige	50
Reo	100
Saxon	10
Scripps-Booth	20
Olympian	4
Jordan	5
Winton	5
Grant	25
White	0
Monroe	25
Paterson	4
Jackson	0
Total	2838

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New Illinois Super-Drive Tractor

BLOOMINGTON, ILL., Feb. 3—The Illinois Tractor Co. is building a new tractor to be known as the Illinois Super-Drive. It will be exhibited for the first time at the Kansas City Tractor Show.

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
- Muriatic, lb. ..... .02 -.03
- Phosphoric (85%).. .35 -.39
- Sulphuric (60%), lb. .008

Aluminum:
- Ingot, lb. ..... .30 -.33
- Sheets (18 gage or more), lb. ..... .42
- Antimony, lb..... .07½-.07⅝

Burlap:
- 8 oz., yd..... .10½
- 10½ oz., yd..... .16½

Copper:
- Elec., lb. ..... .18¾-.23
- Lake, lb..... .21

Fabric, Tire (17¼ oz.):
- Sea Is., combed, sq. yd. 1.62
- Egypt, combed, sq. yd. 1.30
- Egypt, carded, sq. yd. 1.27
- Peelers, combed, sq. yd. .97
- Peelers carded, sq. yd. .95-1.05

Fibre (⅛ in sheet base), lb. ..... .50

Graphite:
- Ceylon, lb. ..... .09 -.22
- Madagascar, lb. .. .10 -.15
- Mexico, lb. ..... .03¾

Lead, lb. ..... .0475-.0525

Leather:
- Hides, lb. ..... .18 -.35½

Nickel, lb. ..... .40

Oil:
- Gasoline:
  - Auto, gal. ..... .24½
  - 68 to 70 gal..... .30½
- Lard:
  - Prime City, gal..1.90-2.00
  - Ex. No. 1, gal...1.10
- Linseed, gal. 1.45-1.48
- gal. 1.10-1.12
- Petroleum (crude):
  - Kansas, bbl. 2.25
  - Pennsylv'a, bbl..4.00
- Menhaden (Dark).

Rubber:
- Ceylon:
  - First latex pale crepe, lb. ..... .56
  - Brown, crepe, thin, clear, lb. ..... .50
  - Smoked, ribbed sheets, lb..... .54
- Para:
  - Up River, fine, lb. .58½
  - Up River, coarse, lb. ..... .34
  - Island, fine, lb... .49

Shellac (orange), lb. .70 -.72

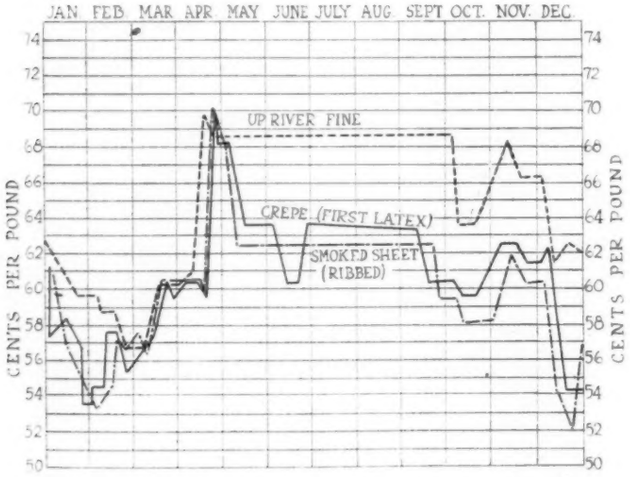
Spelter ..... .07

Steel:
- Angle beams and channels, lb. .... .03
- Automobile sheet (see sp. table.)
- Cold rol'ed, lb. .... .0625
- Hot rolled, lb..... .039

Tin ..... .71 -.72

Tungsten, lb. 1.50-2.10

Waste (cotton), lb... .12¾-.17


JAN. FEB. MAR. APR. MAY. JUNE JULY AUG. SEPT OCT. NOV. DEC.
UP RIVER FINE
CREPE (FIRST LATEX)
SMOKED SHEET (RIBBED)
CENTS PER POUND
CENTS PER POUND

Price fluctuations of Up River Fine, First Latex Crepe and Smoked Sheet crude rubber during 1918. *Government control, which limited shipments, affected prices throughout most of the year*

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock	$5.95	$5.85
Automobile body stock, deep stamping	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
- Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
- Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
- Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
- Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.

Black Sheet Extras to Apply to Narrow Widths:
- Oiling, 10c. per 100 lb.
- Patent leveling, 25c. per 100 lb.
- Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close Feb. 1

	Bid	Asked	Net Ch'ge
Auto Body Company	6½	8½	..
Briscoe Motor Car, com.	10½	..	½
Briscoe Motor Car, pfd	40	55	..
Chandler Motor Car	107¾	108¾	+5¾
Chevrolet Motor Car	149	151	..
Cole Motor Car Co.	90	105	..
Continental Motors, com.	7½	8	+½
Continental Motors, pfd	94	97	..
Edmunds & Jones, com.	15	20	—4
Edmund & Jones, pfd.	75	90	..
Electric Storage Bat.	50	53	..
Federal Motor Truck	31	34	—1
Fisher Body Co., com.	40	43	+3½
Fisher Body Co., pfd.	90	92	—2½
Ford Motor of Canada	255	265	+5
General Motors, com.	124⅜	125⅜	—⅝
General Motors, pfd.	83	85	+½
Hupp Motor Car, com.	5½	6½	..
Hupp Motor Car, pfd.	89½	..	..
Kelsey Wheel Co., com.	30	36	—⅛
Kelsey Wheel Co., pfd.	88	95	+2
Manhatten Electric S., com.	..	48	..
Maxwell Motor, com.	29½	30½	+3
Maxwell Motor, 1st, pfd.	52½	53½	+1
Maxwell Motor, 2nd, pfd.	21½	22½	+2
McCord Mfg., com.	32	35	..
McCord Mfg., pfd.	93	96	..

	Bid	Asked	Net Ch'ge
Mitchell Motor Co.	24	30	..
Motor Products Corp.	..	40	..
Nash Motors Co., com.	170	200	+10
Nash Motors Co., pfd.	93	97	—½
National Motor Co.	6	10	..
Packard Motor Car, com.	116	123	+1
Packard Motor Car, pfd.	99	103	—1
Paige-Detroit Motor, com.	23½	24½	+½
Paige-Detroit Motor, pfd.	8¾	9¾	..
Peerless Motor Truck	18	21	..
Pierce-Arrow Mot. Car, com.	40	41	+¼
Pierce-Arrow Mot. Car, pfd.	101	104	—¾
Premier Motor Corp., com.	5	..	..
Premier Motor Corp., pfd.	..	75	..
Prudden Wheel Company	16	17	+½
Reo Motor Car Co.	21½	22½	+¼
Republic M. Truck, com.	37½	40	—½
Republic M. Truck, pfd.	87	90	..
Saxon Motor Car, com.	8	10	+1¾
Scripps-Booth Corp.	21	25	..
*Stewart Warner Spd. Corp.	83¼	85¼	—3¼
Stromberg Carburetor Co.	39	41	+6
Studebaker Corp., com.	50¼	51¼	+1⅛
Studebaker Corp., pfd.	92	95	—½
Stutz Motor Car Co.	48	49	—1
United Motors Corp.	35⅜	37⅜	+1¾
White Motor Co.	46⅜	47⅜	+1⅝

	Bid	Asked	Net Ch'ge
*Willys-Overland, com.	24¼	25¼	+¼
Willys-Overland, pfd.	87¾	88	—½
RUBBER STOCKS			
Ajax Rubber Co.	70	70¾	+¾
Firestone T. & R., com.	140	145	—5
Firestone T. & R., pfd.	95½	100	..
Fisk Rubber Co., com.	88	90	—1
Fisk Rubber, 1st pfd.	97	100	..
Fisk Rubber, 2nd pfd.	85	90	..
Fisk Rubber, 1st pfd. conv.	100	105	..
Goodrich, B. F., com.	61	61¼	+3
Goodrich, B. F., pfd.	102½	103	+½
Goodyear T. & R., com.	247	252	+17
Goodyear T. & R., 1st pfd.	103	105	—1
*Goodyear T. & R., 2nd pfd.	104	105½	+1
Kelly Springfield, com.	77	78	+7
Kelly Springfield, 1st pfd.	91	98	+1
Lee Tire & Rubber Co.	23	23½	+1¾
Marathon Tire & Rubber	..	55	..
Miller Rubber Co., com.	160	165	+18
Miller Rubber Co., pfd.	96	98	..
Rubber Products Co.	114	118	..
Portage Rubber Co., com.	155	160	+10
Swinehart T. & R. Co.	50	60	..
U. S. Rubber Co., com.	75½	76	+1
*U. S. Rubber Co., pfd.	109¼	110	+¼

*Ex Dividend.

Continental Motors Has Surplus of $555,030 Over 1917

DETROIT, Feb. 1—A comparison of the financial statements of the Continental Motors Corp. for 1917 and 1918 shows that the company's surplus for 1918, in spite of war conditions, is $555,030 over 1917. The company has completed its war contracts and has closed down for ten days to take inventory. It is now running at 80 per cent capacity, amounting to 180,000 cars a year, with 5000 men employed.

The following is the comparative financial statement of the two years:

CONTINENTAL MOTORS STATEMENT

Assets	1918	1917
Property account	$7,395,722	$7,201,808
Investments at cost	31,756	6,756
Deposit with trustee for retir'm't of pfd. stock	1,243	———
Inventories	6,022,357	5,068,956
Accounts and notes receivable—less reserve	1,840 596	1,428,092
Liberty Loan bonds	210,996	———
Thrift stamps	1,229	———
Cash in banks and on hand	172,818	369,421
Deferred charges to future operations	48,552	42,879
	$15,725,270	$14,117,912
Liabilities		
Capital stock	$10,448,070	$10,720,070
Notes payable	850,000	1,025 000
Accounts payable	1,828,945	855,179
Accrued payrolls, taxes, int., etc.	1,042,645	517,083
Surplus	1,555,610	1,000 580
	$15,725,270	$14,117,912

After deducting canceled army contracts, the company's books Oct. 31 last showed orders amounting to $19,781,000. In the fiscal year 494 stockholders were added, making the total 3961.

The profits for the year were $3,045,545. After deducting the amount reserved for federal excess profits and income taxes, $515,000; depreciation provisions, $524,508, and the interest on borrowed money amounting to $66,253, there remained a balance or net profit for the year of $1,939,785.

The company's financial statement shows $75,000 was added to land investment, principally by purchase of 33 acres adjoining its Muskegon plant, giving that plant 50 acres. Inventory was increased about $950,000, much of which represents material bought for government work. In the fiscal year dividends amounting to $238,281 were paid on preferred stock and $1,401,066 on common. Allowing for dividends and reserves, a balance of $1,555,610 remained in surplus, an increase of more than $500,000 over 1917.

The income statement shows a balance of $1,939,785 for net profits after allowing $1,105,760 for interest and depreciation charges, reserves and federal income and excess profit taxes, federal taxes being estimated at $515,000.

Richardson Heads Studebaker Foreign Sales

NEW YORK, Feb. 5—D. B. Richardson, who was manager for the Studebaker Corp. in South America, with headquarters in Buenos Aires, has taken charge of Studebaker foreign sales. His headquarters will be in South Bend.

Moline Plow Co. Makes Report Covering 15 Months

MOLINE, ILL., Jan. 31—Net profits equivalent to 9.14 per cent per annum on the common stock are disclosed in the report of the Moline Plow Co. for the 15 months ending Oct. 31. This is arrived at after providing for dividends on the first and second preferred stocks and after charging all operating expenses, including depreciation allowance and interest on borrowed money. The profit and loss surplus as of Oct. 31, 1918, stands at $2,717,512.

ASSETS

	1918 (15 months)	1917 (12 months)
Real estate, etc	$8,409,151	$7,168,940
Stock in treasury	.....	13,800
Sundry investments	429,150	53,073
Inventories	17,970,585	11,297,144
Cash	946,394	1,038,771
Cash, investments, inventories, etc., in Europe	1,465,879	2,647,450
Receivables, domestic	4,921,782	6,681,391
Other assets	481,358	255,077
	$34,624,302	$28,975,646

LIABILITIES

Capital stock	$19,000,000	$19,000,000
Seven per cent serial gold notes	6,000,000	.....
Bills payable	4,754,000	6,680,000
Accounts payable	690,706	1,088,454
Wages and sundries	176,373	.....
Customers' deposits	378,783	198,327
Accrued charges	657,950	180,383
Reserves	478,979	380,999
Surplus	2,717,512	1,447,646
	$34,624,302	$28,975,646

Bill to Validate Contracts Is Passed

(*Continued from page* 331)

AN ACT

To provide relief where formal contracts have not been made in the manner required by law.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That whenever during the war emergency and prior to Nov. 12, 1918, any individual, firm, company, corporation, or foreign Government has made an agreement with the Secretary of War, or with any officer or agent acting under his authority, or with any agency of the Government authorized to procure for the War Department, for the production, manufacture, sale, acquisition or control of equipment, materials or supplies, or for services, or for facilities, or other purposes connected with the prosecution of the war, and such agreement was reduced to the form of a contract or accepted procurement order and executed or signed on behalf of the Government, but the agreement did not comply with statutory requirements, in every such case the Secretary of War is authorized and directed to waive, on behalf of the Government, such noncompliance: Provided, That he finds such waiver is not inconsistent with the public interest, and in this event the said agreement shall have the same validity and effect it would have had if such statutory requirement had been complied with: And provided further, That such waiver shall not validate such contract or procurement order in so far as any claim for unearned profits may be involved.

That whenever, prior to said Nov. 12, 1918, any individual, firm, company, corporation, or foreign Government has made any agreement, oral or written, express or implied, with, or has received any order or request, oral or written, from the Secretary of War, or any officer, agent, or agency as aforesaid, for any of the purposes aforesaid, and the same has not been reduced to contract form, or when the Secretary of War has not waived such noncompliance, but such individual, firm, company, corporation, or foreign Government has in good faith made expenditures, incurred obligations, acquired or furnished facilities, equipment, materials, or supplies, or rendered services, in reliance on such agreement, order, or request, in every such case the Secretary of War is authorized and directed, on behalf of the Government, to enter into such contract with such individual, firm, company, corporation, or foreign Government as will, under all the circumstances, fairly and equitably compensate him or it for the expenditures made, obligations incurred, equipment, materials, or supplies furnished or acquired, or services rendered, as aforesaid: Provided, That in no event shall such contract provide for compensation on terms more favorable than the terms, if any, for which the aforesaid agreement, order, or request may have provided.

That whenever, prior to said November twelfth, nineteen hundred and eighteen, the War Department, through its officers or agents, has taken possession of any land, or whenever the holder or owner of any land has removed from or removed any improvements from such land at the order or request of the War Department and no valid contract has been made with respect thereto, then the Secretary of War, if he finds that the public interest does not require the possession or occupancy of such land by the Government, is authorized to make compensation to the owner or holder thereof for the fair value of such improvements so removed and the expense incurred by such owner in removing therefrom or for the fair value of the use of such land of which the War Department has taken actual possession and for any expense or loss incurred by the owner or holder by reason of such possession.

Sec. 2. That a commission is hereby created and established, to be known as the War Contracts Appeals Commission (hereinafter referred to as the commission), which shall be composed of three members, who shall be appointed by the President, by and with the advice and consent of the Senate, and shall continue in office for one year from the date of this Act. One member of the commission shall represent the War Department, one member shall represent the Department of Justice, and one member shall represent the business interests of the country. None of the members of the commission shall be interested in any order, contract, or agreement within the purview of this Act or have any interest in any firm or corporation having such orders, contracts, or agreements. Each member of the commission shall receive a salary of $7500 a year, payable in the same manner as the salaries of judges of the courts of the United States. The commission shall choose a chairman from its own membership and may appoint a secretary, who shall receive a salary not exceeding $5000 a year, to be determined by the commission and payable in the same manner as the salaries of the members of the commission.

That there is hereby appropriated, for the purpose of defraying the reasonable expenses of the commission, including the payment of salaries herein authorized, out of any money in the Treasury of the United States not otherwise appropriated, available immediately and until expended, the sum of $50,000.

That within thirty days of the date when the Secretary of War offers any contract or compensation as provided in this Act or refuses to offer such contract or compensation, the party to whom said contract or compensation is tendered or refused, or the Government by a duly authorized officer from the Department of Justice may file with the chairman of the commission a notice of appeal: Provided, however, That if the representative of the Department of Justice agrees with the action of the War Department there shall be no appeal by the Government, but settlement can be made at once. If the Secretary of War shall refuse to waive noncompliance with statutory requirements in respect to any agreement within the purview of the first paragraph of section one of this Act or upon the expiration of sixty days from the date of the taking effect of this Act shall have failed to waive such noncompliance, the contractor named in any such agreement may, within thirty days after such refusal or after the expiration of such sixty days file with the chairman of said commission a notice of appeal. In all cases where an appeal is taken hereunder the commission shall proceed to examine and review the facts and circumstances

of the case and make its award or finding thereon according to the justice and equity thereof. Upon giving receipt in full of all demands against the United States arising out of the transaction by reason of which the award is made, the appellant shall be entitled to receive the amount of any award so made, and the proper officer of the United States is hereby authorized and directed to pay the same, but if the appellant is dissatisfied with the amount so awarded he shall be paid seventy-five per centum of the amount awarded and shall be entitled to sue the United States in the Court of Claims to recover such further sum as added to said seventy-five per centum shall make up such amount as will be fair and just compensation as provied in this Act, and the Court of Claims is hereby given jurisdiction to hear said suit and render judgment thereon.

That whenever the Secretary of War and the contractor shall fail to agree in the matter of the adjustment or settlement, or as to the interpretation or application of the terms of any contract which has been made for any of the purposes set forth in this Act, and in the execution of which there has been compliance with statutory requirements, or compliance has been waived as herein provided, the contractor or the Government by a duly authorized officer from the Department of Justice may give notice to the Secretary of War of intention to appeal to the commission, and provided notice of appeal is filed with the chairman of the commission within thirty days: Provided, however, That if the representative of the Department of Justice agrees with the action of the War Department there shall be no appeal by the Government but settlement can be made at once. On an appeal being taken the commission shall thereupon proceed to determine the questions at issue as set forth in said notice of appeal; and the contractor shall be entitled either to receive the whole amount of such award as may be made as in full of his claim on the questions submitted or seventy-five per centum of the same and sue the United States in the Court of Claims for any remainder, all as provided next above as to agreements otherwise within the purview of this Act.

That in executing the duties and powers conferred by this Act the commission may make its own rules and regulations and may hear and determine issues informally. It shall be the duty of the Secretary of War to furnish to the commission such evidence, documents, or papers pertaining to transactions as to which notice of appeal has been filed as the commission may request. The commission is authorized in its discretion to appoint an examiner in any region or district when such region is within the United States where in its judgment the taking of additional testimony is necessary to the determination of any case. Such examiner shall be a resident of the region or district for which he is appointed, and shall not have any interest, directly or indirectly, in any contract or transaction coming before him or receive any compensation save and except such per diem compensation and expenses as shall be fixed by the commission. Whenever the commission shall refer to any such examiner any claim presented hereunder, the examiner shall proceed, under the direction of the commission, to hear the parties, take the proofs, and return the same to the commission with his recommendations thereon as promptly as possible: Provided, That in no case shall any award either by the Secretary of War, the commission, or the Court of Claims include prospective or possible profits on any part of the contract beyond the goods and supplies delivered to and accepted by the United States and a remuneration, which may include a reasonable profit, for expenditures and obligations or liabilities necessarily incurred in performing or preparing to perform said contract or order; Provided further, That the foregoing proviso shall not apply to any contract executed in compliance with all statutory requirements.

Sec. 3. That nothing in this Act contained shall be held to validate any such contract unless the officer who was at the time of the making of such contract the chief of the division or bureau, as the case may be, in which said contract was negotiated, or in the event that such officer was not responsible for the making of such contract, then the officer in such division or bureau who was so responsible, together with the officer who signed said contract, shall each severally make and subscribe to an affidavit in writing, giving the definite terms of such contract, the name or names within his knowledge, of any such officer or officers who took part in the negotiation or making of the same, and stating whether or not within his knowledge any officer aiding in such making was interested, directly or indirectly, in said contract, and in addition subscribing to an oath to be appended to said affidavit in substantially the following form and tenor:

"I, _____, Chief of the Division or Bureau (naming it) in which the contract hereinbefore mentioned was negotiated, at the time of negotiation thereof, and the officer in the Division or Bureau (naming it) responsible for the making of the contract hereinbefore mentioned, and I, _____, the officer who actually signed said contract, do hereby each severally swear that I am not and was not at the time of the making of said contract directly or indirectly interested in said contract."

That in respect to any such contract as to which any one of said officers can not take the foregoing oath, or after diligent search or inquiry by the contractor can not be found, or is at the time actually engaged in foreign service, or refuses to take said oath, then upon such facts and the fact required in the oath of such officer, appearing by an affidavit of the contractor, or of one of its partners, chief officers, or chief agents acting in its behalf, the Secretary of War shall promptly report such contract to the War Contracts Appeals Commission, and furnish to said commission such evidence, documents, and papers pertaining to the transaction as may be within his control, and such commission may request, and original jurisdiction is hereby vested in said commission to hear and determine said claim with the powers and upon the procedure hereinbefore described in this Act. Said commission shall make its award or finding thereon, and deny said claim or grant it in whole or in part, according to the justice and equity thereof, and the award or finding shall have the same force and effect, and create the same rights as if made under the provisions of section three of this Act. And it shall be the further duty of said commission in hearing, investigating, and determining such claim to find and determine whether any of such officers is or was at the time of the making of said contract directly or indirectly interested in said contract.

Sec. 4. That nothing in this Act contained shall be construed to validate any agreement, contract, or order procured by fraud or to relieve any officer or agent of the Government from prosecution under the penal statutes of the United States for any fraud, criminal conduct, illegality, or irregularity in connection with any of the agreements or orders referred to herein or the execution or signing thereof. In all proceedings hereunder witnesses may be compelled to attend, appear, and testify, and produce books, papers and letters, or other documents; and the claim that any such testimony or evidence may tend to criminate the person giving the same shall not excuse such witness from testifying, but such evidence or testimony shall not be used against such person in the trial of any criminal proceeding.

Sec. 5. That no settlement of any claim arising under the provisions of this Act shall bar the United States Government through any of its duly authorized agencies, or any committee of Congress hereafter duly appointed, from the right of review of such settlement, nor the right of recovery of any money paid by the Government to any party under any settlement entered into, or payment made under the provisions of this Act, if the Government has been defrauded, and the right of recovery in all such cases shall extend to the executors, administrators, heirs, and assigns, or any party or parties: And provided further, That nothing in this Act shall be construed to relieve any officer or agent of the United States from criminal prosecution under the provisions of any statutes of the United States for any fraud or criminal conduct: And provided further, That this Act shall in no way relieve or excuse any officer or his agent from such criminal prosecution because of any irregularity or illegality in the manner of the execution of such agreement: and Provided further, That the names of such contractors and the amounts of such partial or final settlements shall be filed with the Clerk of the House for the information of Congress and printed in the Congressional Record, or as a public document, within ten days after such confirmation.

Sec. 6. That whenever, under the provisions of this Act, the Secretary of War shall make an award to any prime contractor who shall have sublet any part of said contract for material, equipment, or supplies to any other person, firm, or corporation who has in good faith made expenditures, incurred obligations, rendered service, or furnished material, equipment, or supplies to any prime contractor, with the knowledge and approval of any agent of the Secretary of War duly authorized thereunto, the Secretary of War shall apportion the amount of said award justly due to each of the subcontractors of said prime contractors. Before payment of said award the Secretary of War shall require any prime contractor to present satisfactory evidence of having paid said subcontractors or of the consent of said subcontractors to look for their compensation to said prime contractor only; and in the case of the failure of said prime contractor to present such evidence or such consent, the Secretary of War shall pay directly to said subcontractors the amount found to be due under said award; and in case of the insolvency of any prime contractor the subcontractor of said prime contractor shall have a lien upon the funds arising from said award prior and superior to the lien of any general creditors of said prime contractor.

Sec. 7. That the Secretary of the Interior be, and hereby is, authorized and directed to ascertain and determine the amount or amounts of money heretofore invested or contracted to be invested and obligations incurred by any and all persons and investors for producing or for the purpose of producing or preparing for producing, within the United States, to supply the urgent, published, and evident needs of the Nation during the war, any ores, metals, minerals, or mineral substances mentioned and enumerated in an Act of Congress approved October fifth, nineteen hundred and eighteen (public, numbered two hundred and twenty), entitled "An Act to provide further for the national security and defense by encouraging the production, conserving the supply, and controlling the distribution of those ores, metals, and minerals which have formerly been largely imported, or of which there is or may be an inadequate supply"; the production of which by any claimant or claimants was requested, or demanded, by personal solicitation of, or personal inducement to, such claimant or claimants made by the War Industries Board, the Shipping Board, or the Department of the Interior.

And that said Secretary ascertain, determine, adjust, liquidate and out of the moneys provided and appropriated by said Act pay to the parties entitled thereto the amount of such loss and damages as he, the said Secretary, shall find and determine have been sustained and suffered or are likely to be sustained and suffered, by reason of having made such investments for said purposes or having produced surplus stocks of such materials; and that in each case he shall make such determination, provision, settlement, advancement, or final payment, and by agreement with owners and claimants make such other adjustment, or take such other action as he shall find and determine to be just, equitable, reasonable, and expedient; and that he make such provisions as he may deem necessary, advisable, and reasonable to prevent further losses pending final decision, settlement, and disposition in any case or cases; that the payments herein authorized be made to the claimant or claimants the said Secretary shall find to be morally, equitably, and justly entitled thereto; that in ascertaining and determining the losses and damages sustained or to be sustained, and the adjustments, settlements, payments, and provisions to be made, the said Secretary shall consider the prices and conditions existing at the time of each investment and the prices and conditions existing prior to the war, as well as those existing at the time of such determination, adjustment, and settlement, together with all of the circumstances and conditions of each case; that the final determination, decision, provision, disposition, and action of said Secretary in each case shall be conclusive and final; that all payments shall be made and all expenses incurred by the Secretary paid from the funds and appropriations provided and appropriated by said Act of October fifth, nineteen hundred and eighteen (public, numbered two hundred and twenty), and that said funds and appropriations shall continue to be available for said purposes until such time as the said Secretary shall have fully exercised the authority hereby granted and performed and completed the duties hereby provided and imposed: Provided, however, That said Secretary shall consider, approve, and dispose of only such claims as shall be made hereunder and filed with the Department of the Interior within three months from and after the approval of this Act.

That a report of all operations under this section, including receipts and disbursements, shall be made to Congress on or before the first Monday in December of each year.

That nothing in this section shall be construed to confer jurisdiction upon any court to entertain a suit against the United States.

Amend the title so as to read: "An Act to provide relief in cases of contracts connected with the prosecution of the war, and for other purposes."

Passed the House of Representatives January 9, 1919.
Attest: SOUTH TRIMBLE,
Clerk.

Passed the Senate with amendments January 28 (calendar day, January 30), 1919.
Attest: JAMES M. BAKER,
Secretary

Contracts

WASHINGTON, Feb. 1—The following contracts were placed by the Motors Division, Quartermaster Department:

Dodge Bros., Detroit, motor equipment. Set of equipment to accompany each order motors A-45 and motors A-46, at $75.17 each.

Dodge Bros., Detroit, crating and box. Box and crate for export at $53 each, as per P. S. and T. Bulletin No. 22.

Dodge Bros., Detroit, substitute equipment. Substitute for 500 sets of equipment for Dodge delivery wagons, as per attached list.

Dodge Bros., Detroit, price determined. Price on 1000 sets extra equipment in original contract now determined at $75.17 per set.

Ford Motor Co., Detroit. War tax changed to $14.07 instead of $14.51 as originally specified.

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WASHINGTON, Feb. 1—Following is a list of contracts made by the Bureau of Aircraft Production:

Dayton Engineering Laboratories Co., Dayton, 3 No. 8245 Delco Liberty "12" generator assemblies, $94.05.

Dayton Engineering Laboratories Co., Dayton, 1 Liberty "12" rotor brush and spring, Delco system, $0.25.

Dayton Engineering Laboratories Co., Dayton, 100 distributor brush and spring assembly No. 12712, for Delco system on Liberty "12," $3.25.

Dayton Engineering Laboratories Co., Dayton, 4 distributor brush and spring assembly No. 13712, for Delco system, Liberty "12," $0.13.

Dayton Engineering Laboratories Co., Dayton, 1 Delco generator, No. 8245, Delco system on Liberty engine and 1 voltage regulator No. 8542, Delco system, on Liberty engine, $36.05.

Dayton Engineering Laboratories Co., Dayton, 1 Delco switch No. 8408 and 2 distributor assemblies with coils. 12229; Delco system on Liberty "12," $70.95.

Dayton Engineering Laboratories Co., Dayton, 6 No. 12602 armature assemblies, Delco system on Liberty "12"; 6 No. 12616 field-coil assemblies, Delco system on Liberty "12," $63.42.

Splitdorf Electric Co., Newark, 100 magneto parts, $1,430.

Dayton Engineering Laboratories Co., Dayton, 12 distributor brushes No. 13712 (Delco on Liberty "12"), $0.39.

Dayton Engineering Laboratories Co., Dayton, 14 items Delco parts Liberty "12," $40.44.

Dayton Engineering Laboratories Co., Dayton, 4 items of Delco parts on Liberty "12," $92.54.

Dayton Engineering Laboratories Co., Dayton, 70 ignition switches No. 8408 Delco (Liberty "12"), $367.50.

Dayton Engineering Laboratories Co., Dayton, 25 breaker arm assemblies No. 12890 (Delco system on Liberty "12"), 25 distributor cams No. 12751 (Delco system on Liberty "12"), $29.50.

Nordyke & Marmon Co., Indianapolis, 100 No. 12515 crankshaft assemblies Liberty "12," $19,789.20.

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WASHINGTON, Feb. 3—The following orders have been placed by the Motors Division, Quartermaster Department:

B. F. Goodrich Co., Akron, 797 casings and tubes, $11,491 29.

Peerless Motor Car Co., Cleveland, 1 lot spare parts, $19,923.74.

A. J. Detlaf Co., Detroit, 350 clutch assemblies $29,250.

Standard Motor Truck Co., Detroit, 225 standard 3½ chassis, 225 extra bodies, $695.-250.

Kelly-Springfield Tire Co., Cleveland, 100 casings and 1,050 tires, $30,362.

Troy Wagon Works, Troy, Ohio, 350 No 212 trailers, $372,750.

Kelly-Springfield Tire Co., Cleveland, 2,560 solid-pressed tires, $102,144.

Trailmobile Co., Cincinnati, storage agreement entered into provides that contractor receive as compensation 25 cents per day for each article stored, payable upon final delivery f. o. b. Cincinnati. Ordnance Nos 12808 and 2226 ME.

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Great Britain to Continue War-Time Restrictions on Automobile Apparatus

(*Continued from page* 290)

from the Board of Trade is permission to import a couple of chassis to be used for exhibition purposes only. These must not be sold under penalty of a severe fine. Most of the importers have already taken advantage of this ruling and are importing show or exhibition chassis. The same is true of commercial trucks, and will undoubtedly apply to farm tractors.

The importers are having a harder load to carry now than during the war. War orders have stopped and their men are returning from the army and are demanding their old jobs and efforts are being made to take all of them back. The repair work is increasing and the demand for spares is four times what it was in December. This assures good business for the repairshops, but the returning sales organizations have not a bright future for immediate employment.

But the importers have yet another load on their shoulders. Many of them have held together their entire dealer organizations throughout the British Isles. It is nothing short of wonderful how this has been done. One large importer, with nearly 150, has not lost a single dealer in four years. They have all had war work and those who went to war had their business carried on by others. Some of them have become manufacturers of no mean stature. One case in point is a Liverpool dealer who during the war has had 1000 employees and had two or three manufacturing plants. He has been manufacturing airplane wings as well as other parts.

Now that the war is over, these dealers are anxious to get back into business. Their war trade has ceased and repair work is now their only source of revenue excepting the sale of used cars. Every day the importers are literally besieged by these dealers, and they in turn are getting more inquiries than they have received for four years regarding post-war models, car prices, possible dates of delivery, etc.

The recent decision announced by the Board of Trade to continue the total prohibition order on imports is very disquieting to this army of dealers, who feel that as business men who built up legitimate businesses before the war and took their part during the war, that now they are not being fairly treated, and not given that business co-operation which they feel the Government owes them.

While these dealers are marking time the dealer handling British cars is little better off. His factory has been on war munitions since 1914, and has no cars on hand. All he has regarding post-war models in most instances are assurance of deliveries in August and September and in some cases October. Few of the British factories have as yet quoted prices, and but a small percentage of them have issued specifications of post-war models. There are exceptions, notably concerns that have been building cars during the war for army use, and one or two others who have post-war models ready and hope to make deliveries in April or May.

As to the attitude of the new Parliament on the importation of automobiles in the next year, nothing definite is known, but the decision of the Board of Trade is so explicit that there is no room for doubt. The Board of Trade ruling was made after the new Cabinet was formed, and Sir Albert Stanley, the president, is an appointee of the present Cabinet. In view of this, it can only be interpreted as the ruling of the new Cabinet, and as such will stand for some months at least.

There were elected to the new Parliament not fewer than a round dozen of members from the British manufacture. These twelve in nearly every case can be looked upon as protectionists. These members in nearly every case are connected with nearly all of the largest makers. This situation argues for a possible continuation of the restriction of imports. These makers have a strong case. They have been out of production for four years. Some have not been permitted to develop post-war models, and it is almost a certainty that the Government will protect these manufacturers until they can get back on their feet and get into production.

What will take place when the restrictions are removed and perhaps a duty imposed no one can tell. It is certain that free trade will not come back so far as motor cars are concerned. With twelve protectionists in Parliament from the automobile industry, and from the manufacturers generally of higher priced cars of small production, there is not good prospects for a continuation of free imports of automobiles into the British Isles.

No objection can possibly be raised to any protectionist policy on the part of Great Britain. France has her import duty of 70 per cent, America has her 45½ and 30 per cent custom duties and the British maker has every right to ask for a share in the same kind of protection. It is not against an import duty that the British importer has ground for complaint, but against an unknown period of continued total prohibition.

Capt. Westmoreland Returns to States

NEW YORK, Feb. 3—Captain H. E. Westmoreland, who has been adjutant of the Air Service Replacement Concentration Barracks No. 3 at St. Maxient, France, for the past eighteen months, is back in the United States. He was for a number of years Southwestern manager for the McQuay-Norris Mfg. Co., St. Louis, with headquarters in Dallas. His future plans are not yet determined.

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W. B. Wood, for 17 years Detroit manager for Fairbanks, Morse & Co., has joined the sales force of the Commerce Motor Car Co., Detroit, to represent it in western territory.

—

Fred I. Tone, formerly with the Marion Co., Indianapolis, and Willys-Overland Co., Toledo, is now chief engineer of the United States Ball Bearing Mfg. Co., Chicago.

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Ray A. Long is back at his old post as chief engineer for the Columbia Motors Co., Detroit. While in government service, from which he was just discharged, he helped develop the Militor Four-Wheel Drive truck.

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J. M. Case, former sales and advertising manager of the United Motors Co., Grand Rapids, has become advertising manager of the Garfield Motor Truck Co. of Lima.

—

G. B. Rickenbaugh, who has been connected with the Irving National Bank for the past two years, was recently elected vice-president and general manager of the Scott Corp., which has general offices in Paris and London, with the main office in Aeolian Hall, New York.

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Herb Flint, Detroit, former distributer of Hupp motor cars in Michigan, is now Western sales manager of the Abbott-Downing Truck & Body Co. of Concord, N. H.

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C. L. Fox has been made sales manager of the Saxon Motor Car Co., Detroit. He has been with the company since its incorporation.

—

E. S. Gellatly, for several years vice-president of the Indian Refining Co., New York, also in charge of its Havoline oil advertising, severed his connection with that company on Jan. 15 to go with the Illinois Zinc Co., New York, where he will be in charge of the formation and organization of a new department.

—

Elbert Warford, who has been in the aviation service, has returned to his former position as advertising manager of the Seattle branch of the B. F. Goodrich Rubber Co.

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Elmer Sperry to Address S. A. E.

CLEVELAND, Feb. 3—Elmer Sperry, inventor of the gyroscope, will address the March meeting of the Detroit Section Society of Automotive Engineers.

Men of the Industry

Changes in Personnel and Position

Don T. Hastings, M. E., has been appointed manager of the Chicago office of Rex W. Wadman, Technical Advertising Specialist, and is in charge of all the business of the concern in the Middle West.

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Charles A. Mayne, formerly of the Firestone Tire & Rubber Co., Akron, who was connected with the Republic Motor Truck Co. of Alma for the last few months, has gone to South America, where he will represent that company.

—

L. E. Colgrove, former Grand Rapids distributer of Hudson cars, has returned from the army and is now selling Cadillac machines for the Becker Sales Co. of that city.

—

J. P. O'Brien has been appointed district manager in Chicago of the central territory of the Anderson Electric Car Co. He has been associated with the company for the past six years.

—

C. Haines Wilson, treasurer and general manager of the C. R. Wilson Body Co., Detroit, recently left for a six weeks' trip to Pasadena, Cal.

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W. H. Luhrs, general manager and member of the Board of Directors of the General Aluminum & Brass Mfg. Co., Detroit, has severed his connections with that company.

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L. E. Lyons, for the past six years sales engineer of the axle division of the Sheldon Axle & Spring Co., has resigned to become associated with the B. F. Everitt Co., Detroit.

—

Fred E. Dean has become associated with the Allied Metal Sales Corp., New York, as Western sales manager, with headquarters in Detroit.

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Frank R. Ryan has been added to the sales force of the Chicago office of the Roller-Smith Co., New York. Previously he was connected with the testing department of the Commonwealth Edison Co. and the Krehbiel Co., consulting engineers, Chicago. For the past six months he has been in the signal corps. He succeeds Charles H. Nicholson, who since his return from service is in charge of the company's Detroit office.

—

F. A. Haines has been promoted from factory manager to general manager at Dodge Bros., Detroit. A. Z. Mitchell, his former assistant, succeeded him as factory manager.

Barney Oldfield Becomes Tire Maker

CHICAGO, Jan. 31—Barney Oldfield, the veteran racing driver, has branched out into the industry as the head of a new tire concern known as the Oldfield Tire Co. He says this definitely marks his retirement from racing.

—

J. H. Kelly, formerly production manager of the Hudson Motor Car Co., Detroit, is now general manager of the Cole Motor Car Co., Indianapolis.

—

Lieut. D. W. Bay has returned to his former position as sales engineer, Hyatt Roller Bearing Co., Detroit, in charge of Illinois, Wisconsin and the Northwest, with offices at 2715 South Michigan Avenue, Chicago. For the past 15 months he has been in the Motors Division, Department of Production, Quartermaster Corps.

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William K. Swift, Philadelphia, has become associated with the sales department of the Bound Brook Oil-less Bearing Co., Bound Brook, N. J.

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Harry H. Hawke, formerly connected with the De Luxe Automobile Co., St. Louis, has been made general sales manager of the Traffic Motor Truck Corp.

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Walter Wilmot, former manager of the Detroit Automobile show, is now manager of the Minneapolis automotive show, which opens Feb. 15.

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J. H. W. Mackie, who resigned as sales manager of the Saxon Motor Corp., is now general manager of the Payne Motor Car Co., Minneapolis.

—

Major John L. Bender has joined the Anderson Forge & Machine Co., Detroit, as sales manager. For the past 15 months he has been the military member of the Priority Committee of the War Industry Board at Washington.

—

Ford Enters Tire Field

DETROIT, Feb. 3—Henry Ford is now making rubber tires for his cars. The Ford Motor Co. has built and is operating a small tire factory producing on a small scale. Only a few tires have been made to date, but plans call for extensive manufacture.

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Advertising Manager Dies at Desk

BOSTON, Feb. 4—George Burkle, advertising manager of Gray & Davis, Inc., died of heart failure at his desk on Friday, Jan. 31.

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Lansing Automotive Leader Dead

LANSING, Jan. 30—Harry E. Bradner, general manager of the Auto Body Co. since that corporation was started in 1901, and later president of the concern until a few weeks ago, died of pneumonia last week. He was also vice-president of the Duplex Truck Co., the Gier Pressed Steel Co. and the Auto Wheel Co., all of Lansing. The Auto Body Co. was started with a capital stock of $20,000, which recently was increased to $2,000,000.

Studebaker Additions Will Increase Working Population

SOUTH BEND, Feb. 3—At a dinner tendered him by the South Bend Chamber of Commerce, Jan. 30, A. R. Erskine, president of the Studebaker Corp., stated that within a few months Studebaker cars will be built completely in South Bend, as well as in Detroit, the production totaling 500 complete cars per day, when the extension plans are in operation.

The factory additions caused by the Government contracts which were under way when the armistice was signed, in which shells, tractors and other munitions were to be produced, will form the beginning of the extension, which will cover 61 acres, and provide 4,000,000 sq. ft. of floor space, requiring from 7000 to 12,000 employees. The new equipment includes everything from a foundry to the final car assembling.

The whole plan, however, hinges on the housing question, for this expansion will mean doubling the present working population of the city, and the Chamber of Commerce last night started on plans for providing homes for these people. Housing facilities for 10,000 men and 2000 women will have to be provided, one-half of whom will be at work by Dec. 1 of this year and the other half six months later.

—

No Drop in Packard Prices

DETROIT, Jan. 30—The Packard Motor Car Co. is extensively advertising the fact that there will be no change in Packard prices. The company states that as there was no rise in Packard prices during the war period, there is consequently no leeway for reduction at this time.

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300 Dodges Turned Out a Day

DETROIT, Jan. 31—Dodge Brothers are turning out 300 machines a day. A portion of the plant is still engaged in war work. The Dodge car, being one of the standard makes chosen by the army, is being still purchased by the government. The company is also working on parts orders for the repair and maintenance of its machines in federal service. There are 10,000 men on the payroll. When at full capacity 18,000 men are employed.

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Maxwell Now at Daily Rate of 150

DETROIT, Jan. 31—The Maxwell Motor Car Co. is producing 150 cars daily, and expects to increase this output materially in the immediate future.

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Dort Production Normal Again

FLINT, MICH., Jan. 30—The Dort Motor Car Co. has about finished government work and is back at normal car production. The plant is turning out 40 cars daily, and its 1919 production schedule calls for 15,000 machines. The next three or four weeks will see the last government job completed. This winds up over $3,000,000 of war contract work which called for the manufacture of "AA" trucks, trailers, truck "C" bodies and cutting boards.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

Salvaged Scrap Saves $3,000,000

AKRON, Feb. 1—An indication of the conservation methods of the Goodyear Tire & Rubber Co. may be gained from the fact that the by-products during the year salvaged scrap and waste material to the amount of $3,000,000.

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Curtiss Advertising Department at Garden City

BUFFALO, Feb. 1—The advertising department of the Curtiss Aeroplane & Motor Co. has been moved from the Buffalo plant to Garden City, L. I.

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Amazon Rubber Co. Issues Extra Dividend

AKRON, OHIO, Jan. 31—The Amazon Rubber Co., which held its annual meeting Saturday, showed an increase in business during 1918 of 85 per cent over 1917. An extra dividend of 12½ per cent was issued. Officers for the coming year were elected as follows: President, Albert Kroehle; vice-president, J. A. Burger; treasurer and general manager, L. J. Schott; secretary and general superintendent, L. F. Smith.

—

Grant Reduces Price $130

CLEVELAND, Feb. 1—The Grant Motor Car Corp. this week issues a new schedule of prices for Grant-Six cars, to take immediate effect. The new prices reveal a reduction of $130 on each machine, as follows:

Model	New Price	Old Price
Grant-Six touring car	$1,120	$1,242
3-passenger roadster	1,120	1,242
3-passenger coupé	1,625	1,755
All weather sedan	1,645	1,775
Demountable sedan	1,400	1,530

The Grant corporation guaranteed its dealers against a price decrease up to May 1.

—

Ward LaFrance Drops Prices

ELMIRA, Feb. 3—The Ward LaFrance Truck Co. has reduced the price of its 2-ton truck $150 and of its 3½-ton truck $175.

	New Price	Old Price
2-ton truck	$3,350	$3,500
3½-ton truck	3,750	3,925

—

Acme Truck Scheduled for 1400 in 1919

CADILLAC, Jan. 30—The Acme Motor Truck Co. is producing approximately four trucks daily. The production schedule for this year calls for the manufacture of 1400 trucks. The 1919 machine embodies no radical design changes, but has been improved upon in a number of minor respects. The company is anticipating no price reduction, and is guaranteeing its distributers against a cut.

Changes in Executive Force of Pennsylvania Rubber

JEANNETTE, Jan. 31—At a special meeting of the Board of Directors of the Pennsylvania Rubber Co. on Jan. 27, George W. Daum was elected second vice-president in charge of production, and A. H. Price was elected second vice-president in charge of sales. James Q. Goudie, formerly sales director in charge of the Middle West district, who represented the company in Washington regarding its Government business, was elected general sales director, in charge of branch sales, with headquarters at Detroit.

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New Aultman-Taylor Tractor Model

MANSFIELD, OHIO, Feb. 3—The Aultman & Taylor Machinery Co. is building a new model tractor to be known as the 22-45. This will supersede the former models 18-36 and 22-50. Plans are being made to get this model on the market in a very short time.

—

No Price Reduction in Saxons

DETROIT, Jan. 31—The Saxon Motor Car Corp. has assured its dealers that it will protect them against a reduction in the price of its cars. Prices will positively not drop before June 1. In case the company finds it necessary to cut prices, the new contract which Saxon purchasers sign calls for an appropriate refund.

—

Government Airplane Factory for Fisher Body Corp.

DETROIT, Feb. 3—Fisher Body Corp. is now endeavoring to lease or purchase the airplane factory adjoining its plant, built by the Government for aircraft production. Federal officials are now in the city. An inventory and survey of the plant is under way, and the matter will probably come to a head in the course of a few days.

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Paterson to Increase Production

FLINT, MICH., Jan. 30—The W. A. Paterson Co., makers of Paterson 6-cylinder cars, will increase daily production about April 1. This company is now running 20 cars per week and is preparing to deal more extensively in the foreign market. The new 1919 car varies but slightly from the 1918 model. The company does not plan a price reduction, and is guaranteeing to give distributers 60 days' notice if such a course is decided upon.

—

Allen Motors Resuming Pre-War Production

FOSTORIA, OHIO, Jan. 31—The Allen Motor Co. is fast getting back to pre-war production.

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Grant to Make 12,000 Cars

CLEVELAND, Jan. 30—The Grant Motor Car Corp. plans the production of 12,000 cars during the coming year. Twenty-five machines are being turned out daily, but plans for increased production are already in effect.

Calendar

ENGINEERING

S. A. E. Meetings

March 5 — Minneapolis Section, S. A. E.—Hotel Radisson. "Tractor Service and Sales."

April 2—Minneapolis Section, S. A. E. — Hotel Radisson. "Implements Designed for Tractor Belt Power and Their Characteristics."

MOTOR SHOWS

Feb. 1-15—New York. Automobile Dealers' Assn. Charles A. Stewart, Manager, Hotel Woodward, Broadway and 55th St.

Feb. 6-15—San Francisco, Cal. Third Annual Pacific Automobile Show, Motor Car Dealers' Assn. of San Francisco, Exposition Auditorium. G. A. Wahlgreen, Manager.

Feb. 10 - 15 — Rochester, N. Y. Rochester Automobile Trades Assn., Exposition Park. George C. Donahue, Manager.

Feb. 12-15—Defiance, O. Second Annual Show under auspices of Defiance Automobile Dealers' Assn.

Feb. 15-22—Newark, N. J. N. J. Auto Exhibition Co. Calude Holgate, Manager.

Feb. 15-22 — Cleveland, Ohio. Cleveland Auto Show Co. Fred H. Caley, Manager.

Feb. 15-22—Minneapolis, Minn. Minneapolis Auto Trade Assn. Walter B. Wilmot, Manager.

Feb. 15-22—Albany, N. Y., Albany Automobile Dealers' Assn. State Armory.

Feb. 16-22—Waco, Tex. Henry B. Marks, Manager.

Feb. 17-22—St. Louis. St. Louis Auto Mnfrs. & Dealers' Assn. Robert E. Lee, Manager.

Feb. 17 - 22 — Louisville, Ky. Louisville Auto Dealers' Assn.

Feb. 17-22—Des Moines, Iowa. Tenth Annual, Des Moines Automobile Dealers' Assn. C. G. Van Vliet, Manager.

Feb. 17-22 — Pittsfield, Mass. Pittsfield Automobile Dealers' Assn., State Armory. James J. Callahan. Manager.

Feb. 17-22 — Passenger Cars; Feb. 24-27, Trucks—South Bethlehem, Pa. Lehigh Valley Auto Shows Co. J. L. Elliott, Manager.

Feb. 17-22—Grand Rapids, Mich. Grand Rapids Automobile Business Assn. E. T. Conlon, Manager.

Feb. 17-22—Seattle, Wash. Cars, Motor Car Dealers' Assn., State Armory. A. G. Schaeffer, Manager.

Feb. 18-22—Baltimore, Md. Baltimore Automobile Dealers' Assn. and Automobile Club of Maryland, Fifth Regiment Armory, H. M. Lucius, General Manager.

Feb. 18-22 — Oklahoma City, Okla. Automotive Show. R. H. Haun, Manager.

Feb. 19-22 — Evansville, Ind. Cars, Evansville Automobile Dealers' Assn. Coliseum.

Feb. 22-Mar. 1—Hartford, Conn. Hartford Automobile Dealers' Assn., Inc., Broad Street Armory. Ben. F. Smith, Manager.

Feb. 22-Mar. 1—Atlantic City, N. J. Auto Trades Assn. of Atlantic City.

Feb. 22-Mar. 1—New Castle, Pa., Lawrence County Association of Automobile and Accessory Dealers.

Feb. 23-March 1—Cedar Rapids. Auditorium, Automobile Dealers' Assn.

Feb. 24-Mar. 1—Burlington, Ia. Second Annual.

Feb. 24-March 1—Kansas City, Mo.—Kansas City Motor Dealers' Assn. E. E. Peake, Manager.

Feb. 24-Mar. 1 — Springfield, Mass. Automobile Dealers' Assn. Harry W. Stacy, Manager.

Feb. 24-Mar. 1—Portland, Ore. Ninth Annual Dealers' Motor Car Assn., Automobile Palace. M. O. Wilkins, Manager.

Feb. 25-Mar. 1 — Erie, Pa., United States Garage.

Feb. 26-Mar. 1—Mason City, Ia. Fifth Annual, Mason City Auto Show Assn.

Feb. 26-Mar. 1—Madison, Wis. Seventh Annual, Automobile Dealers' Division of Madison Assn. of Commerce, Union Transfer Bldg.

Feb. 26-Mar. 1 — Quincy, Ill. Cars, Quincy Automobile Trade Assn. Armory.

Feb. — Wheeling, W. Va. Automobile show at Market Auditorium.

March 1-15—New York Aeronautical Exhibition, Manufacturers' Aircraft Assn., Madison Square Garden and 69th Regiment Armory.

March — Scranton, Pa. Thirteenth Regiment Armory, Scranton Automobile Assn.

March—Utica, N. Y. Utica Motor Dealers' Assn. W. W. Garabrandt, Manager.

March—Philadelphia, Pa. Philadelphia Automobile Trade Assn. Passenger cars.

March 1-8—Detroit, Mich. Detroit Automobile Dealers' Assn. H. H. Shuart, Manager.

Mar. 3-5—Quincy Ill. Trucks and Tractors. Armory.

March 3-8—Columbus, O. Columbus Automobile Show Co., Memorial Building. W. W. Freeman, Manager.

Mar. 3-8 — Muskegon, Mich. Third Annual, Armory, Muskegon Lodge No. 274, B P. O. E. John C. Fowler and George M. Friant, Managers.

Mar. 3-8—Scranton, Pa. Ninth Annual, 13th Regiment Armory, Scranton Automobile Assn. Hugh B. Andrews, Manager.

March 3-8—Buffalo, N. Y. Buffalo Automobile Dealers' Assn.

Mar. 5-8—Lancaster, Pa. Automobile Trade Assn., Rowe Motor Co.'s Bldg. R. W. Shreiner, Manager.

Mar. 8-15 — New Brunswick, N. J. Armory, New Brunswick Motor Trade Assn. William Kuehle, Manager.

March 10-15—Paterson, N. J. Paterson Automobile Trade Assn., Fifth Regiment Armory. H. MacGinley, Show Manager.

March 10-15—Syracuse, N. Y. Syracuse Automobile Dealers' Assn. Harry T. Gardner, Manager.

March 10-15 — Omaha, Neb. Fourteenth Annual. Omaha Automobile Trade Assn., Auditorium. Clark G. Powell Manager.

March 12-19—St. Joseph, Mo. Sixth Annual. St. Joseph Automobile Dealers' Assn.

March 15-22 — Boston, Mass. Boston Automobile Dealers' Assn. Passenger cars only. Chester I. Campbell, manager.

March 15-22—Harrisburg, Pa. Harrisburg Motor Dealers' Assn., Overland Warehouse. J. Clyde Myton, Manager.

March 17-22 — Great Falls, Mont.—Montana Automobile Distributors' Assn.

March 19-22—Norfolk, Neb. Norfolk Automobile Show Assn.

March 22-29—Pittsburgh Automobile Dealers' Assn. of Pittsburgh. John J. Bell, Manager.

March 22-29. Passenger Cars; April 1-5, Trucks—Brooklyn. Brooklyn Motor Vehicle Dealers' Assn. I. C Kirkham, Manager.

Mar. 24-29 — Greenfield, Mass. Greenfield Automobile Dealers' Assn., State Armory. James J. Callahan (Pittsfield) Manager.

Mar. 24-29—New Orleans, La. Henry B. Marks, Manager.

Mar. 26-29—Watertown, N. Y. Tenth Annual, State Armory, Automobile Dealers, Inc. Arthur E. Sherwood, Manager.

Third week March—Trenton, N. J. Trenton Auto Trade Assn. John L. Brock, Manager.

April 5-12—Montreal, Can.—National Motor Show of Eastern Canada, Victoria Rink. T. C. Kirby, Manager.

Not decided—Bridgeport, Conn. Auspices of City Battalion. B. B. Steiber, Manager.

Not decided—Indianapolis, Ind. Indianapolis Auto Trade Assn. John B. Orman, Manager.

June 2-6—Hot Springs, Va. Convention, Automotive Equipment Assn., Homestead Hotel.

TRACTOR SHOWS

Feb. 15-22—Minneapolis, Minn.

Feb. 18-22—Wichita, Kan. Annual Mid-west Tractor and Thresher Show. Wichita Tractor and Thresher Club. Forum.

Feb. 24-March 1—Kansas City, Mo. Fourth Annual Tractor Show. Sweeney Building, Kansas City Tractor Club. Guy H. Hall, Sec.

RACES

Mar. 15—Santa Monica, Cal., Speedway.

May 17—Uniontown, Pa., probably 112½ miles.

July 5—Cincinnati, O., Speedway.

CONVENTIONS

Feb. 19—New York. 13th annual banquet of Aero Club of America, Waldorf-Astoria.

Feb. 25-28—New York. Sixteenth Annual Convention. American Road Builders' Assn.

Feb. 25-28 — Ninth American Good Roads Congress and 16th Annual Convention of the American Road Builders' Assn. Hotel McAlpin, New York.

Apr. 10-12—Philadelphia. National Assn. of Motor Truck Sales Mgrs., Bellevue-Stratford.

April 24-26—Chicago — National Foreign Trade Council Sixth National Foreign Trade Convention. Congress Hotel.

Buda Has Three New Tractor Engines

HARVEY, ILL., Feb. 1—The Buda Co. will exhibit at the Kansas City tractor show, to be held from Feb. 24 to March 1, three new types of heavy duty tractor engines. These will be of the same general design as the 4¼ x 5½ in. engine which made a 103-hour non-stop run at the Salina tractor demonstration last summer. They have been developed and tested during the past year.

The largest of the new models is a 4-cylinder, 5 x 6½ in. bore and stroke engine having a piston displacement of 510.5 cu. in. Another, also a 4-cylinder engine, has a bore and stroke of 4½ x 6 in. They are block cast, with removable heads and full pressure lubrication.

It is stated that these engines are especially suited for multiple plow work in new soil, on large acreage and in the heaviest kind of duty, using low grade or heavy fuels.

Jackson May Quit Passenger Car Field

JACKSON, Feb. 1—The Jackson Automobile Co. will not place a passenger car on the market this year. While the company is still undecided on its future policy and will make no formal statement at this time, it is understood that it proposes hereafter to devote its entire time to the production of trucks. The company is just winding up a large government shell contract.

New Die Casting Co. for Milwaukee

MILWAUKEE, Feb. 3—The Wisconsin Die Casting Co. has been incorporated here with a capital stock of $25,000 to engage in the general die casting business. The incorporators include Gustave R. Hurz, Julius O. Roehl, attorney, and Fred H. Koch.

Lewis Steel Products Co. Changes Hands

TOLEDO, Jan. 30—The controlling interest in the Lewis Steel Products Co. has been purchased by a group of Detroit and Cleveland parts manufacturers. Additions to the plant will be started at once and a new plant will be erected later. George L. Lewis, president and founder, has disposed of all his interest in the concern, and A. R. Clas, for nine years with the Falls Motor Corp., of Sheboygan, has taken over the management. It is understood that Mr. Lewis will organize another company to manufacture automobile parts.